Construction Methods

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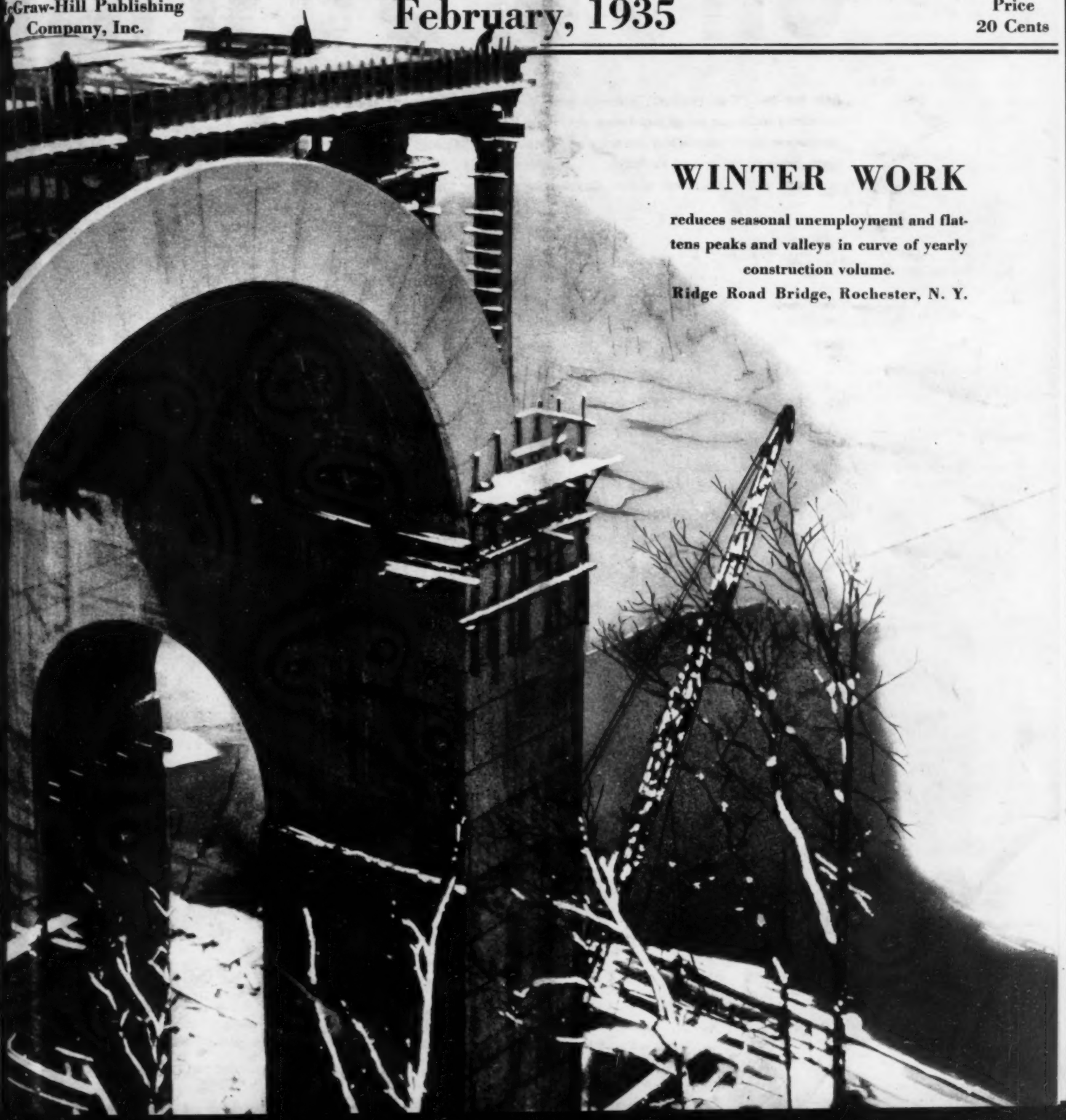
Price 20 Cents



WINTER WORK

reduces seasonal unemployment and flattens peaks and valleys in curve of yearly construction volume.

Ridge Road Bridge, Rochester, N. Y.

CALL FOR A SHOW-DOWN

Ask for the "Caterpillar" Show-Down—a demonstration of Diesel power and economy on *your own* job doing *your* work. See for yourself—and check performance with operation records of "Caterpillar" Diesel Tractors and Engines that have been giving faithful, trouble-free service for thousands of hours on scores of different power tasks. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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DIESEL

Construction Methods

McGraw-Hill Publishing Company, Inc.,
330 West 42nd St., New York

ROBERT K. TOMLIN, Editor

FEBRUARY, 1935

WILLARD CHEVALIER, Vice-President

Editorial Staff: Vincent B. Smith, N. A. Bowers (San Francisco)
Leonard H. Church (Cleveland), Nelle Fitzgerald

Cassel, in the Brooklyn Daily Eagle

Make Room for Better Homes and Employment

Echoes of the Road Builders' Convention

● If the sentiments expressed at the sessions of the Highway Contractors' Division of the American Road Builders' Association at its convention in Washington, D. C., last month are representative of the general attitude of the industry, there exists a widespread dissatisfaction with present working conditions governing road building by contract under existing code requirements and special federal and state rules and regulations. In fact, this dissatisfaction assumed the proportions of revolt when the divisional group endorsed plans for the reorganization of the Highway Contractors' Division into a militant body, with an individual legalized identity under the A.R.B.A., to fight solely and directly for the interests of the highway contractor. In matters of code formulation and administration, as well as those of legislation affecting construction, the highway contractor feels that his interests have been subordinated to those of the building contractor. It is probable, therefore, that a movement for a highway contracting code entirely separate and distinct from the existing construction codes will be launched.

Code Assessments

● What seems to rankle highway contractors most with regard to present code administration is failure of enforcement combined with the necessity of paying the code assessment fee of one-tenth of 1 per cent of the value of contracts without getting, they claim, much, if anything, in return for their contribution. Outside the highway field, in which practically all construction at present is with federal or state money and under direct federal and state supervision, the road contractors contend that great laxity exists in complying with the obligation of paying code assessments. At this writing NRA has failed to approve the proposed subdivisional code (Chapter 2c) for highway contractors, thus putting this group in the position of financing code administration expenses for other branches of contracting without having a code applicable directly to their own industry.

Conflict of Regulations

● Then, too, while highway construction nominally is regulated by existing code provisions it does, in fact, operate for the most part under entirely different rules, established by competent governmental authority, which take precedence over code requirements. In short, highway contractors contend that they are required to pay fees for the administration of codes under which they are not permitted to work.

Mandatory Selection of Personnel

● Code grievances, however, constitute only part of the highway contractor's complaint. By far the greatest handicap to the performance of efficient and profitable work under federal and state supervision has been the mandatory selection of construction personnel from local reemployment lists. A highway contractor today cannot operate with his own trained and experienced organization. On each new job he must build up a new personnel recruited from the county in which the job is located. A large majority of the candidates for work, in both the unskilled and skilled classifications, know little or nothing about road building and require long and costly instruction in their duties. In the case of the so-called "skilled" machine operators many contractors report thousands of dollars of direct added expense for repairs to costly equipment damaged by ignorant, incompetent handling by recruits from the relief lists. With labor of this sort forced upon the road builder by governmental mandate the preparation of reliable estimates of the cost of work, for bidding purposes, becomes an impossibility. Under present conditions every contractor must figure in his costs a sizeable item to cover the establishment of a training school for inexperienced workers sent to him by local relief agencies, to say nothing of added items to compensate for low working efficiency, reduced production, increased turnover in the labor force and damage to mechanical equipment.

Menace of Day Labor

● Day labor has made serious inroads upon the business of highway contracting and, unless checked, threatens to curtail drastically, if not actually to wipe out, the market for the highway contractor's services. It will be one of the primary functions of the newly organized Highway Contractors' Division of the A.R.B.A., as a measure of self-preservation, to stem the rapidly rising tide of day labor operations in the road-building field. Figures were cited at the meeting to show that on comparable sections of road construction in almost all of the states the cost of work by day-labor exceeded contract cost by about 30 per cent.

The 30-Hour Week

● On road-building operations the basic 30-hr. week established by governmental mandate for federal-aid projects is a target for much criticism. Experience with this measure under the seasonal and climatic conditions that govern highway construction shows that, instead of 30 hr., labor on the highway job has been able, on the average, to secure only 25.8 hr. of work per week. From one state it is reported that under the maximum 30-hr. week a large proportion of the labor is dissatisfied with weekly earnings and complains of transportation costs in connection therewith. This condition has served largely to break down the morale of labor.

A Letter to the President

Honorable Franklin D. Roosevelt
President, United States of America
White House
Washington, D. C.

January 14, 1935

President

Through the National Press News Service, it has come to our notice that you will ask the Congress for four billion dollars for Work Relief in lieu of Direct Relief and that any allotment of monies made by the present Congress for this purpose shall be done by the Day Labor method.

As a representative of the employees group of a large contracting firm, I earnestly and vigorously protest this method of expenditure, and can foresee, if such a course is followed, a further retardation of recovery. Hundreds of thousands of contractors' employees, who have gained their present status through faithful servitude and earnest endeavor, will automatically be thrown on the labor market to compete with the already unemployed, and whereas now, due to their long associations, they hold positions of trust and foremanships, this new proposed method will force them to practically begin life anew, to begin again as a laborer and to stay as such until such times as they can prove their worth to a new employer.

Further, hundreds of us have worked for years to attain a working interest in our respective firms and, if the contract system is abolished, it means that our life's work has gone with it—due to our having attained our present status, thousands of us have created obligations, begun the raising of large families, taking a constructive and active part in civic affairs, and in general, we feel ourselves to be representative citizens. The expenditure of the allotment by the Day Labor method will automatically reduce us to common labor, force our children into work, mortgage our homes, and generally break down the morale of thousands who have been your ardent supporters.

We plead, not only for ourselves, but for the investments of our employers, represented by men most of whom began the same as ourselves, as a common laborer, and virtually pulled themselves up by their own bootstraps and made America what it is today. These men of the Construction Industry were the pioneers of our country and we cannot conceive of a Congress which would be willing, by a stroke of the pen, to JUNK their investments and virtually make paupers of them overnight.

In closing, we again earnestly and respectfully solicit your support to the contract method of all expenditures of public monies, not only for the reasons above enumerated, but as a matter of getting value received.

Yours very truly,

_____

No offering by this writer could compete in interest or force with this authentic letter, here reprinted exactly as it was written by a contractor's employee to the President of the United States. The author's courtesy in permitting this use of it is gratefully acknowledged.

Willard Chevalier

CONSTRUCTION METHODS. February, 1935. Volume 17, Number 2. Published Monthly, price 20¢ a copy. Subscription rates—United States, Mexico and Central and South American countries, $2.00 a year. Canada, including duty, $2.50 a year. All other countries, $4.00 a year or 16 shillings. Entered as second class matter October, 1926, at Post Office at New York, N. Y., under the act of March 3rd, 1879. Printed in U.S.A. Cable address "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

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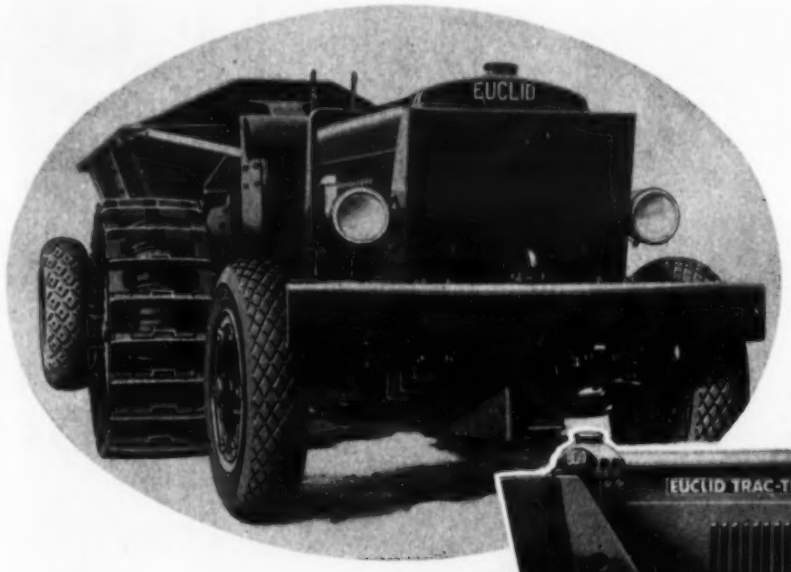
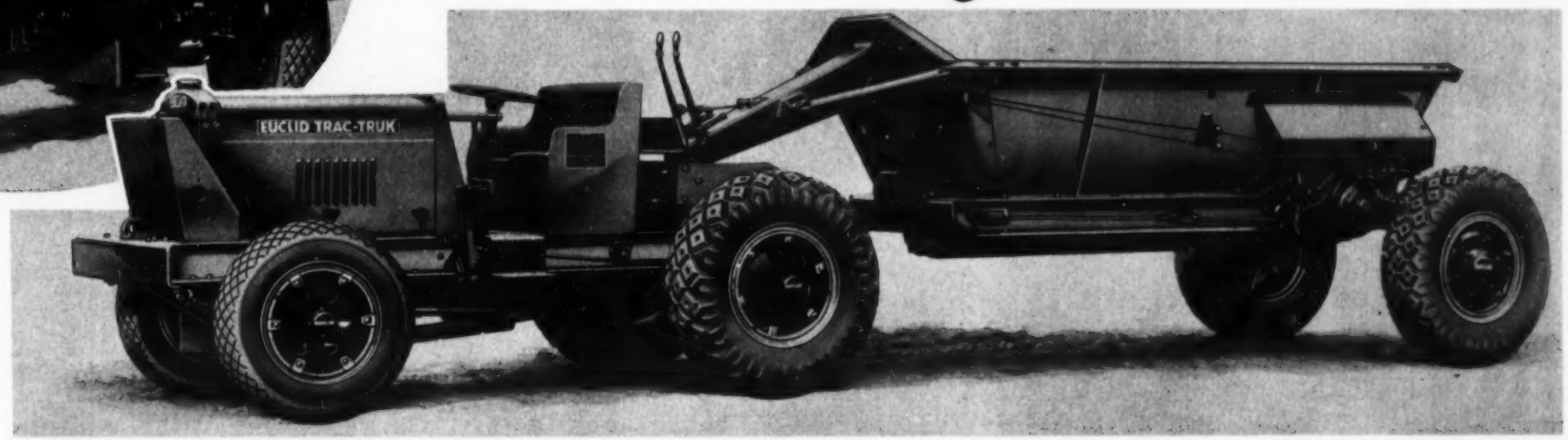


"1935" TRAC-TRUKS WITH EVEN GREATER OPERATING *Refinements*



AND now still finer—faster—sturdier Trac-Trucks delivering even more efficiency and offering greater value to the dirt mover! The 1935 refined model incorporates advanced engineering principles of design and many added features of construction that again effect sensational increases in speed of job operations and lowering of production costs. Having a range of five forward and two reverse speeds—with an extra low (1.28) and a high speed up to twelve miles per hour—every power and speed requirement for heavy duty haulage is admirably covered. The new Wheel Wind is another device that provides a simplified and sure automatic dumping mechanism that approaches the ideal as a time-saving unloading facility. In ruggedness of contsruction and swift mobility, Trac-Truks are away out in front with their rigidly reinforced, solidly braced body design—quick get-a-way—short turning and separate steering brakes for pivoting. Moreover, Trac-Truks are geared to give adequate power when you need it with a powerful motor exerting unusual torque through a low gear ratio to the usable point of final drive, and tire tracks to furnish the extra traction.

● *Big dirt movers will profit by learning the full story—gladly furnished on request—about this refined new series of Trac-Truks.*

THE EUCLID ROAD MACHINERY CO. CLEVELAND, OHIO

THE PIONEER

Performance that Wins *and* holds *Confidence*

THE ability of an electric shovel to *"see it through"* is what *wins* and *holds* confidence. You buy on the basis of *proved performance.*

The performance records of shovels equipped by General Electric have not only won, but have held, the confidence of the users — have backed up their judgment in buying them.

Why are these records so outstanding? One of the reasons is that General Electric has continuously co-operated with leading shovel manufacturers for more than 30 years. This exchange of sound engineering ideas has resulted in equipment that is electrically and mechanically fit, that is economically *right* for the service, and that represents the *correct* answer to the practical problems involved.

Every shovel that is equipped with General Electric apparatus is an *investment in dependability.* General Electric, Dept. 6-201, Schenectady, N. Y.

G-E EQUIPMENT ON THE JOB. G-E equipment—dependable electric servants that stay on the job day and night—asking little for upkeep—getting the most out of construction apparatus—guarding men, machinery, and profits.

The field experience of G-E engineers in applying electric power to all types of construction equipment; the alertness and proximity of G-E service; the dependability of G-E apparatus—these are incomparable aids to the enterprising builder.

See General Electric for all types of electric equipment for construction machinery—motors, control, motor-generator sets, portable substations, wire and cable, insulators, cutouts, transformers, locomotives, battery-charging equipment, floodlights, and air heaters.

020-114

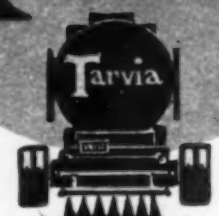
GENERAL ELECTRIC

1911 —While Wooster Pike, near Cincinnati, Ohio, was being Tarvia-built, Americans were thrilled by the first transcontinental airplane flight.

1935 —Transcontinental flying has been cut from 84 hours to 10 hours in the 24 years Wooster Pike's Tarvia pavement has given flawless service.

Barrett

Tarvia

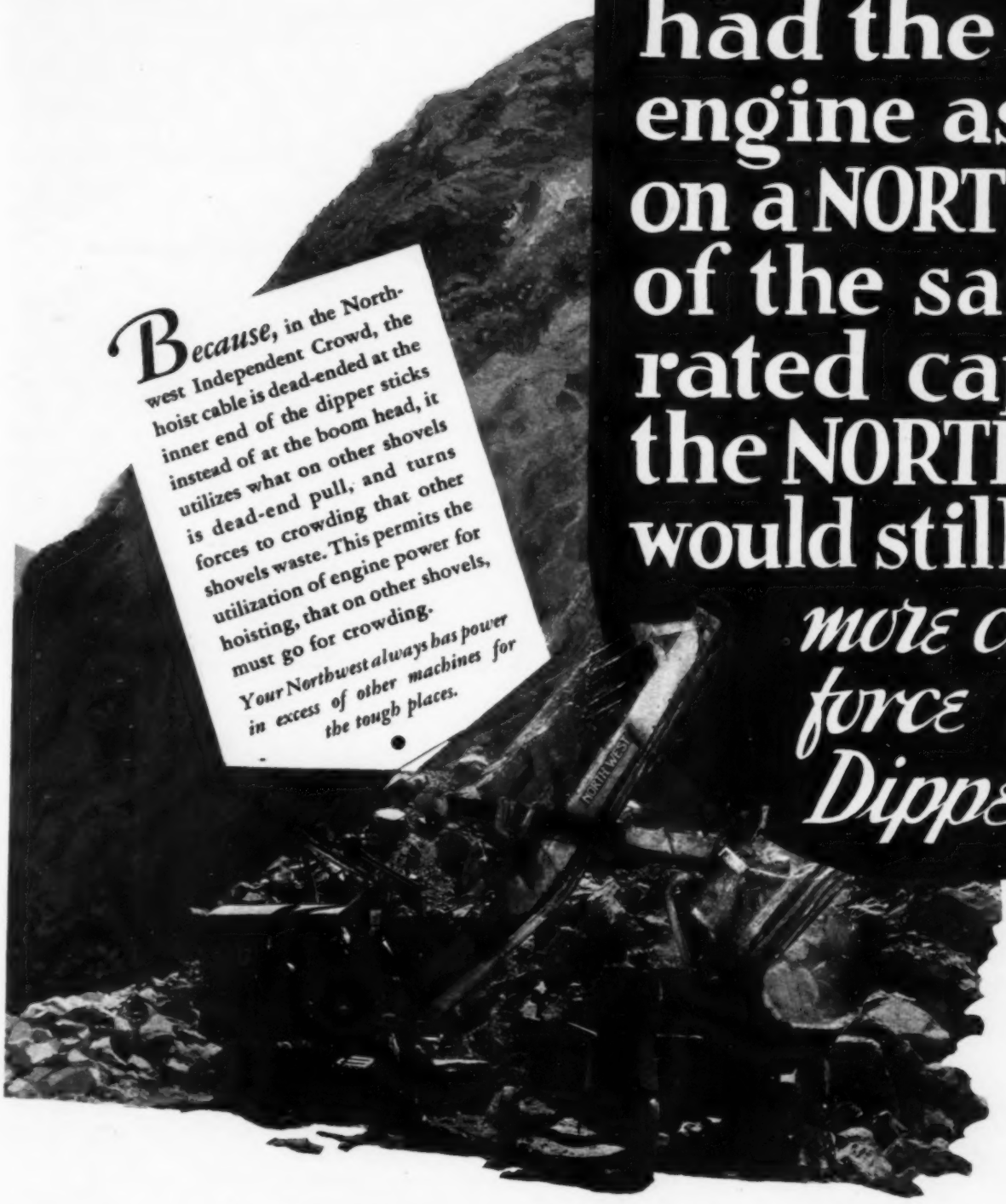


GOOD ROADS AT LOW COST

Twenty-four years of uninterrupted service is not an exceptional performance record for a Tarvia road. Highway officials all over the country have had similar experiences with Tarvia. They know — and appreciate — that Tarvia roads are easy and economical to build, and need only the simplest and most inexpensive maintenance to make them last indefinitely, always smooth, easy-riding and skid-safe.

THE BARRETT COMPANY New York Chicago Philadelphia Birmingham St. Louis Minneapolis Cleveland Boston Detroit Baltimore Youngstown Cincinnati Buffalo Rochester Syracuse Bethlehem Providence Toledo Hartford Portland, Me. Lebanon Columbus Milwaukee In Canada: THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver

Even if YOUR SHOVEL *(regardless of make)* had the same engine as used on a NORTHWEST of the same rated capacity the NORTHWEST would still have *more cutting force at the Dipper Lip!*



Because, in the Northwest Independent Crowd, the hoist cable is dead-ended at the inner end of the dipper sticks instead of at the boom head, it utilizes what on other shovels is dead-end pull, and turns forces to crowding that other shovels waste. This permits the utilization of engine power for hoisting, that on other shovels, must go for crowding.

Your Northwest always has power in excess of other machines for the tough places.

Built in a range of **10 SIZES** *½ yd. capacity and larger*

NORTHWEST ENGINEERING COMPANY

The world's largest exclusive builders of gasoline, oil, diesel or electric powered shovels, cranes, draglines, pullshovels and skimmers

1728 Steger Building 28 East Jackson Boulevard Chicago, Illinois, U. S. A.

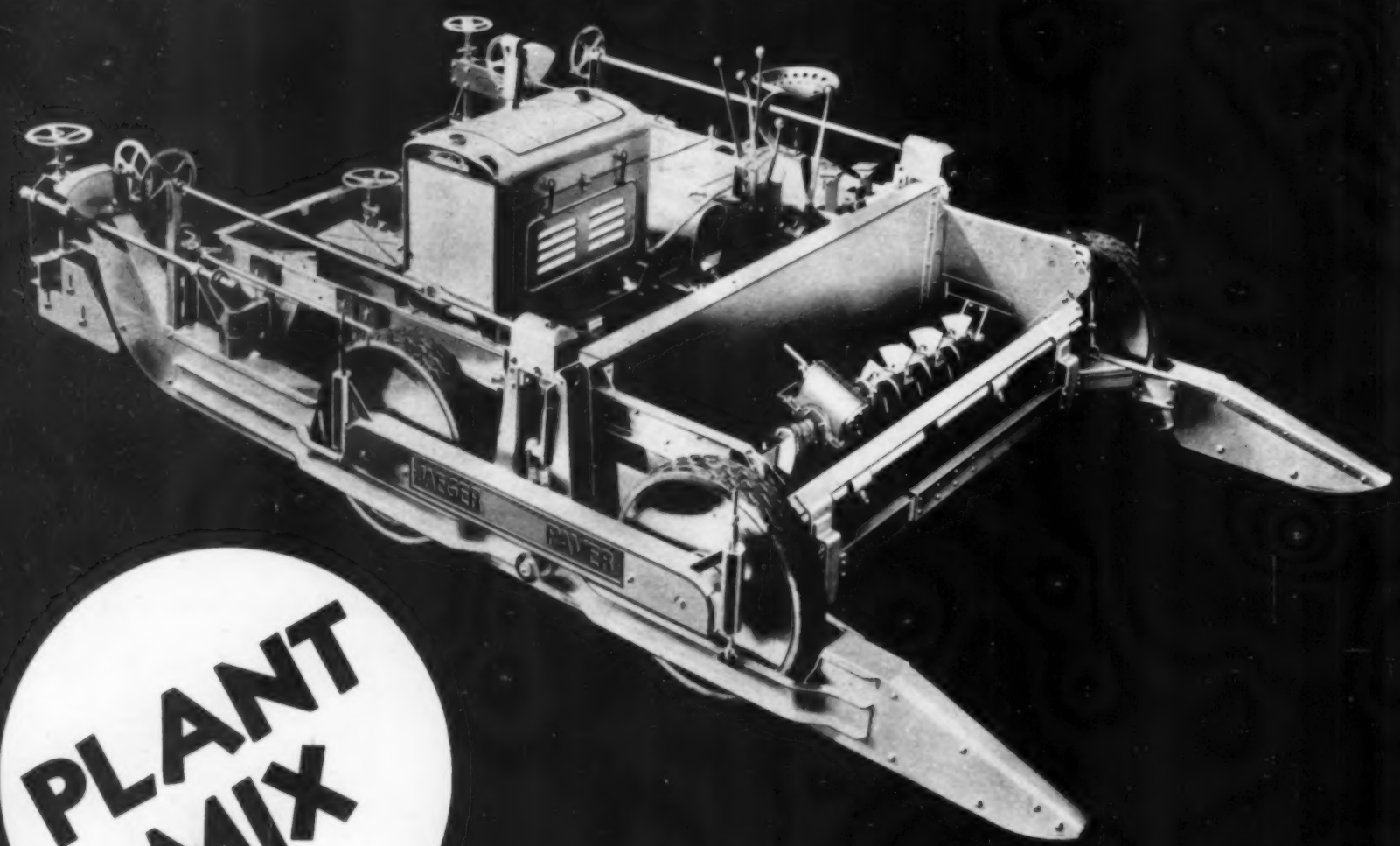
NORTHWEST

SHOVELS •
CRANES •
DRAGLINES •
PULLSHOVELS •
SKIMMERS •

• • •

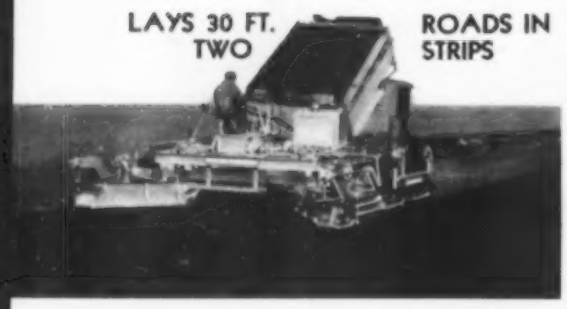
Gasoline •
Oil •
Diesel •
Electric •

JAEGER offers the Latest BITUMINOUS



PLANT MIX

LAYS 30 FT. TWO ROADS IN STRIPS



18 FT. STRAIGHT EDGE RUNNERS

are free floating, carry screed only, act as movable forms which ride "high spots," equalize subgrade, insure smooth riding surface.

MORE THAN A TON A MINUTE ON DIFFICULT U. S. 1

High production on 9½ ft. strip of 1½" Maryland Standard Amiesite Mix in spite of curves, super-elevations with 4% grades and winter temperatures less than 40° F.

JAEGER BITUMINOUS PAVER

Adjustable 9 to 15 feet . . . Lays Roads Smooth as Concrete . . . *without Forms!*

(400 TO 1000 TONS A DAY)

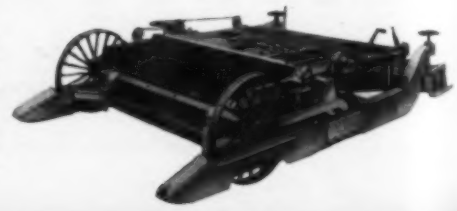
REVOLUTIONARY progress in 1935 road building—a machine that gives smoothness of form jobs without their cost on any well prepared subgrade, with operating advantages never before available to contractors. Level checking device gives greatest accuracy. Meets most rigid requirements of engineers.

Telescopic frame with easy width changes—lays roads up to 30 ft. in 2 strips with only one joint to finish (means up to 50 per cent more tonnage capacity)—Screed carried on 18 ft. full floating, straight edge runners or movable forms which equalize subgrade—All other weight on rubber tired wheels (no traction, no weight on newly laid material, plenty of power on grades to push material trucks ahead—Steers differentially—Powerful reversible "re"-mixing screws control lateral spread—Adjustable blender screeds at rear give smoothly finished joints.

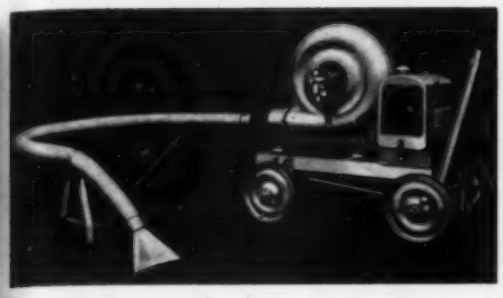
Lays all standard type bituminous materials—all courses—up to 6" thickness—makes BIG SAVINGS in hand work on the job. Backed by 3 years of actual field tests—proven on such difficult jobs as Great Smokies National Park Highway with 435 curves in 8½ miles. Fully described in Jaeger CATALOG BP-2, just issued, covering latest types 1935 road machinery and methods important for road builders. Write for your copy. TODAY.

"VIBRO" Black Top Spreader *(Pulled by Truck)*

This low cost machine can be drawn by heavy trucks with special low speeds—is most rapid spreading box ever offered for gravel, stone, slag, etc. Adjustable, oscillating, vibrated screed also lays binder and top—up to 100 tons per hour with new smoothness and minimum hand work. Four wheels carry load—16 ft. straight edge runners which carry screed are full floating—no traction or weight on newly laid material. Adjustable 9 to 11 ft. thru Blender Screeds.



Type Machine for EVERY Type Road *(with or without forms)*



Dust Blowers

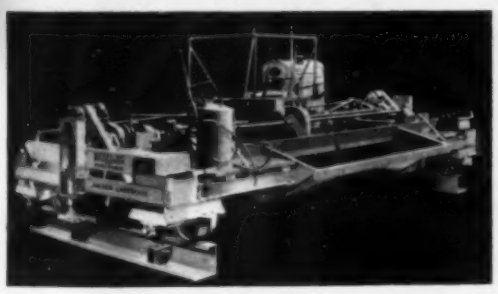
Deliver huge volumes of air over 4 to 6 ft. paths, clean out holes in road bed, insure the perfect bond essential to long life black top roads. Sizes to meet conditions—a profitable investment whether or not specified.

Ask about our GRADE ROOTERS for shoulder and grade preparation work!

Adjustable Asphalt Forms

Cut your form costs! Instead of complete new size form for every job, buy only such inexpensive top rail as job requires. Any height to 5½" mounts on standard 8" base. Jaeger-Lakewood Forms are most rigid built—no material lost from "bowing"—less chance of "high spots."

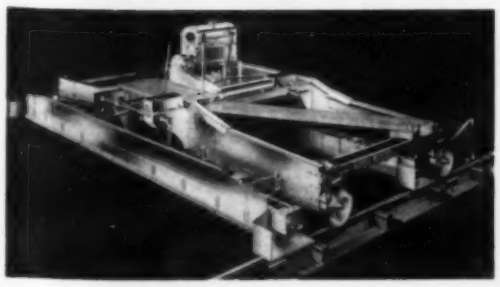
Ask about FORM TAMPER for smoother roads!



"DX" Spreader-Finisher

Powerful 20' machine, "re"-mixes and spreads as well as finishes the black top. Meets need for bigger production (1500 tons daily)—operates on forms or concrete curb, produces finest, smoothest riding roads ever laid. Breaking records on job after job. Write us for details.

Let us show you how the JAEGER-LAKEWOOD SUBGRADER pays out on a single job!



1935 Type "D" Finisher

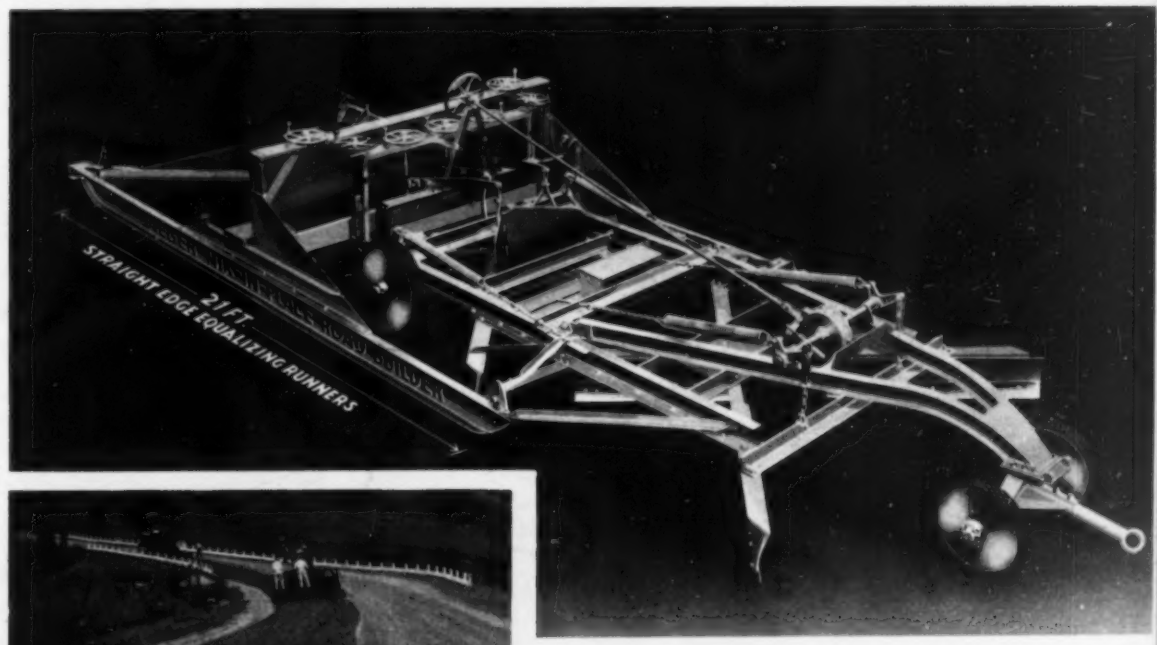
For concrete and highest type bituminous roads and streets, either hot or cold mixed. New "velvet touch" insures perfect riding smoothness with low cost, higher speed production—10,000 sq. yds. per day on 20 ft. road. Adaptable for wedge, binder and top—half widths or up to 30 ft. roads. Many valuable new features for black top work.

Ask about Jaeger "SURE PRIME" PUMPS for transfering asphalt from cars!

WORLD'S RECORD "Mix-in-Place" Road Builder

MIX IN PLACE

(6.8 Miles of 20 Ft. Road in 2 Days on U.S.-50)



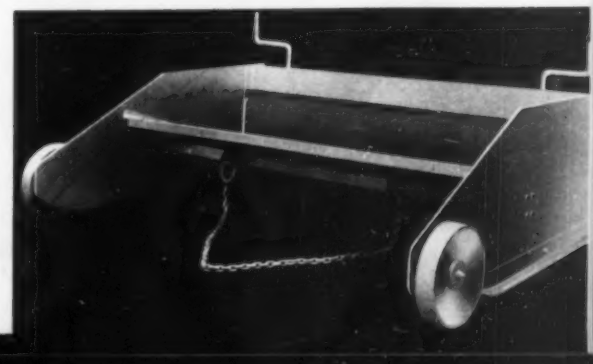
2 Machines (Mixer and Finisher) for Price of 1

THIS "Mix-in-Place" Road Builder, designed by Highway Engineers, mixed and finished new 1" top on 6.8 miles of 20 ft. road on U. S. Route 50 in 2 days with 7-man crews—at total cost of $920 a mile. Job was done in 10 ft. strips (a lane a day) with road kept open to traffic. Sets new standard for riding smoothness due to 21 ft. equalizing runners of finishing unit—gives thoro, uniform mix IN ONE PASSAGE due to 7-fold mixing of multiple plow blade mixing unit. Two units for the price of one—for new roads, resurfacing or maintenance. SEND FOR BULLETIN BP-2A.

THE JAEGER MACHINE CO., 800 Dublin Ave., Columbus, O.

New Type Jaeger Stone Spreader

Matches 7-mile-a-day pace of the Jaeger "Mix-in-Place" Road Builder on 10 ft. strip, spreads stone smoothly to required depth with one setting of dump trucks for continuous, complete discharge. BULLETIN BP-2A gives details.



Since 1931 · · · Inland 4-WAY Floor Plate

Has "Filled the Bill"

Remember the First Inland 4-Way Floor Plate Ad?
October, 1931

Inland 4-Way Pattern
Since February, 1932

INLAND 4-WAY—the most important improvement in floor plate in decades—was announced by Inland in October, 1931.

This new floor plate was far in advance of any plate made; it met the need for a better, more serviceable steel floor plate. Its new 4-Way pattern gave it 4 advantages which could not be secured elsewhere: 4-Way Safety (equal resistance to slippage 4-Ways instead of two); 4-Way Matching; 4-Way Drainage; Extra Stiffness.

Many users of floor plate immediately changed to 4-Way. Many who could see no advantage in the available steel plates over competing material now began to use steel floor plates for the first time—Inland 4-Way.

Today there are hundreds using Inland 4-Way Floor Plate for a great variety of purposes—wherever a foot or wheel may slip. INLAND STEEL COMPANY, 38 So. Dearborn St., Chicago, Illinois.

NRA CODE

INLAND STEEL

ABLE SERVANT OF THE CENTRAL WEST

Sheets Strip Tin Plate Plates Structurals Piling

Rails Track Accessories Bars Rivets Billets

BLAW-KNOX *knows how to* DESIGN
STEEL FORMS

MERRITT-CHAPMAN & McLEAN CORPORATION

GENERAL CONTRACTORS

OSCAR B. COBLENTZ, Pres.
FRANK B. BEACHAM, Vice-Pres.
W. LEONARD SMITH, Sec'y & Treas.

TELEPHONES PLAZA 3660-3661

1201-3 FIDELITY BUILDING
BALTIMORE, MD.

RAILROADS, BRIDGES
PIERS, BULKHEADS
HIGHWAYS, DREDGING
INDUSTRIAL PLANTS

November 27th, 1934.

Blaw-Knox Company,
Pittsburgh, Pa.

Gentlemen:

We wish to state that the theory of design worked out by your company for the construction and moving of the steel forms for the Fortress Monroe Sea Wall job proved to be well suited to insure quick moving and setting, and maintenance of proper elevations and alignment.

As you know, we were able to pour two 30' sections of wall every working day from early in June until the end of the job, with two bulkhead and two closing-in forms. After the form moving gangs were broken in they had no difficulty in moving and setting one bulkhead and one closing-in form every ten hours. It is our opinion that with no other type of form could this rate of progress been maintained for such a long period.

We appreciate the spirit of cooperation you manifested, and trust that we may have other jobs where your forms can be economically used to the mutual advantage of both of us.

Yours very truly,

MERRITT-CHAPMAN & McLEAN CORPORATION

Oscar B. Coblentz
President.

StC

TO PROMOTE JOB PROGRESS is the reason for the use of Blaw-Knox Steel Forms on any construction project.

Mr. Coblentz's letter, reproduced herewith, indicates that the Blaw-Knox Steel Forms used on his Fortress Monroe Sea Wall job were properly designed and worked out to his economical advantage.

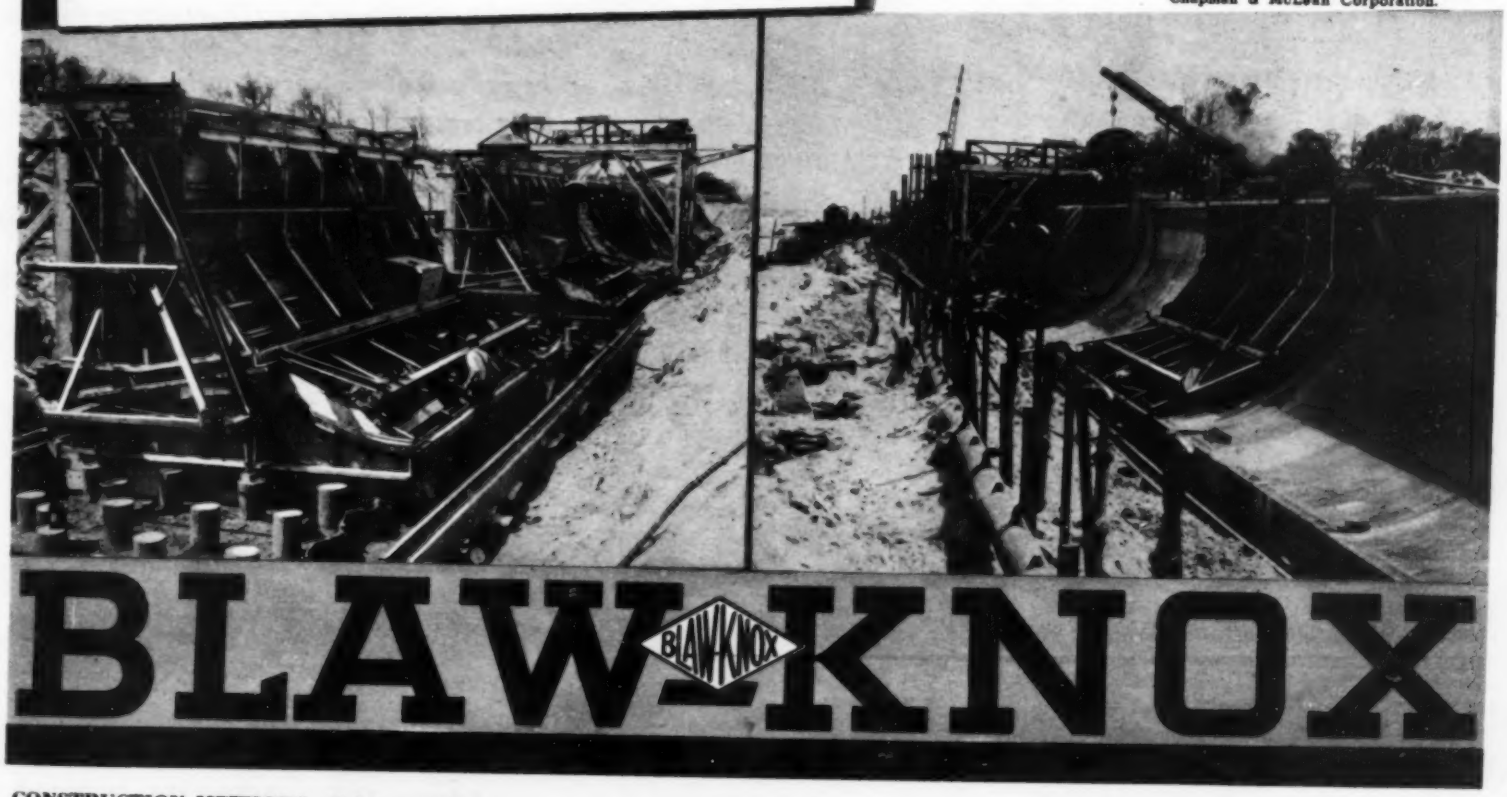
Thousands of contractors have used Blaw-Knox Forms during the past twenty-eight years for large and small concreting jobs of all kinds.

Here is a wealth of experience which means money in the pocket of any contractor who has a form problem and who wants to be assured of a profit out of his low bid.

Blaw-Knox engineering advice is yours for the asking—you are under no obligation.

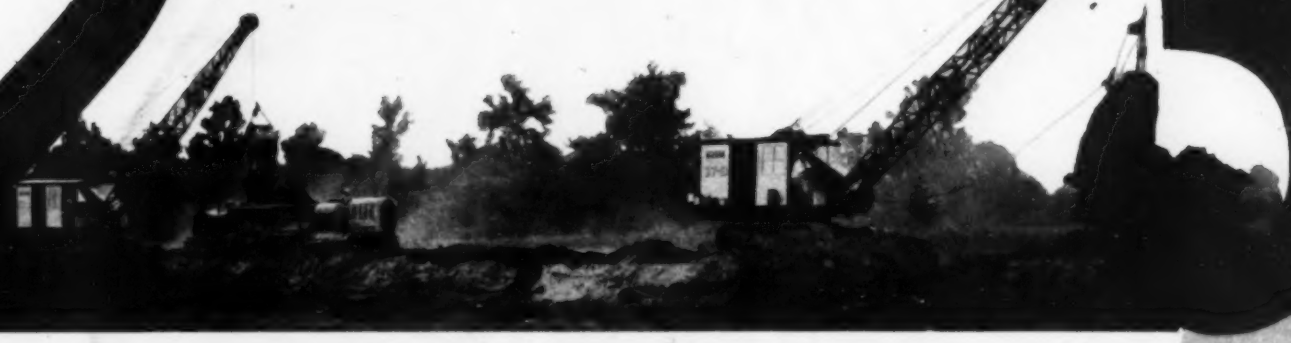
BLAW-KNOX COMPANY
2066 FARMERS BANK BUILDING PITTSBURGH, PA.
Offices and Representatives in Principal Cities

Blaw-Knox STEEL FORMS used on Fortress Monroe Sea Wall—Merritt-Chapman & McLean Corporation.



BLAW-KNOX

2 OF EVERY 3

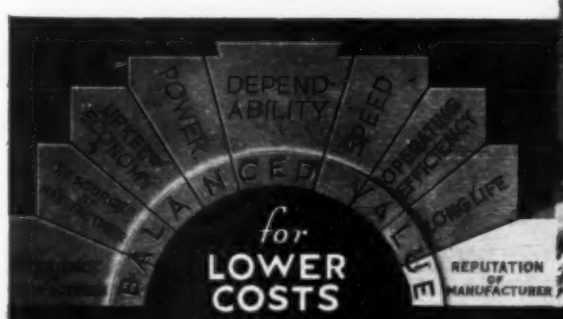


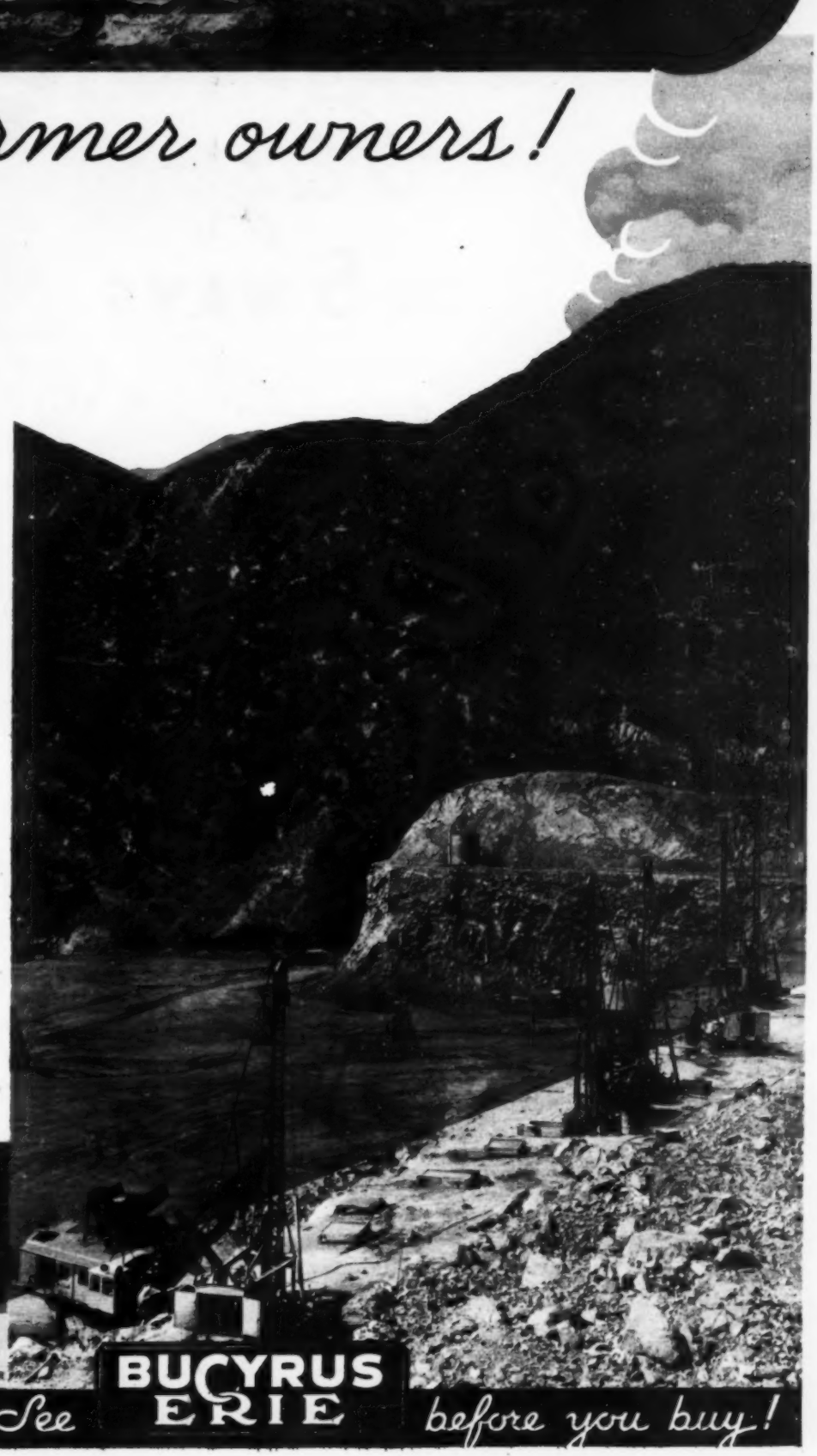
go to former owners!

Two of every three dollars paid for Bucyrus-Erie machines is spent by men who have learned by experience that it is profitable to buy this particular make of machinery.

This is more convincing evidence of profit-making performance than any written testimonial. *Modern* Bucyrus-Eries can bring the same profit-making possibilities to your job . . . whether it be large or small. Bucyrus-Erie Company, South Milwaukee, Wisconsin. Excavating, drilling and material-handling equipment.

843





BUCYRUS ERIE

See BUCYRUS ERIE *before you buy!*

A WISE investment *if you can use it.* Whether or not you can use it will depend on what value you place on each of these 5 basic advantages.

Less Hazard—very important. Cordeau is an *insensitive* detonator, you know.

More work from your Explosives: You may be able to use less or less expensive powder. Cordeau acts as a direct detonating agent for every cartridge in the hole, so that each has the added force of a primer cartridge. Here's a feature you can estimate in dollars.

Simplified Loading is very important in big shots, and can be quite a factor in little ones. Here's another feature that means a saving in time, labor, money.

Better Fragmentation: Less secondary blasting and less delay for your shovel. This is due in part to the fact that the Cordeau hook-up permits shots planned to release burden, and expend more power in *breaking up* the stone.

Fewer but Bigger Shots: If you can use giant blasts you'll make some *real* savings because you can keep your equipment in place until all drilling is completed.

Yes—Cordeau pays in *at least* 5 ways. It will pay you—to look into it anyway. Send for the Cordeau book. The Ensign-Bickford Company, Simsbury, Conn. Estab. 1836.

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...This is a helpful hint, how to make wire rope last longer. Subsequent Wickwire Spencer advertisements in this publication will give other dollar saving information. Tell us about your rope problem and we will give you the answer.

Rapid hoisting always sets up severe vibration in the rope directly above the point of load attachment. There is no known way to prevent it. Although visual examination of the rope at this point may not disclose broken wires, the strength of the section from 5 to 20 feet above the load attachment is bound to be greatly reduced because of crystalline fatigue within the wires. It is therefore advisable to cut this damaged section off periodically even though it may still look sound. About ⅓ the estimated life of the rope is a good interval. A breaking test of the discarded piece proves the wisdom of this safeguarding practise.

●

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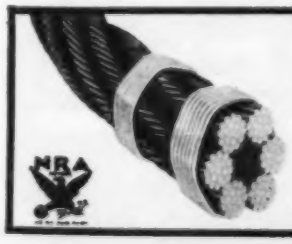
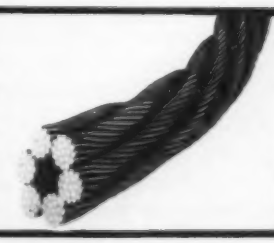
WIRE ROPE
by Wickwire Spencer

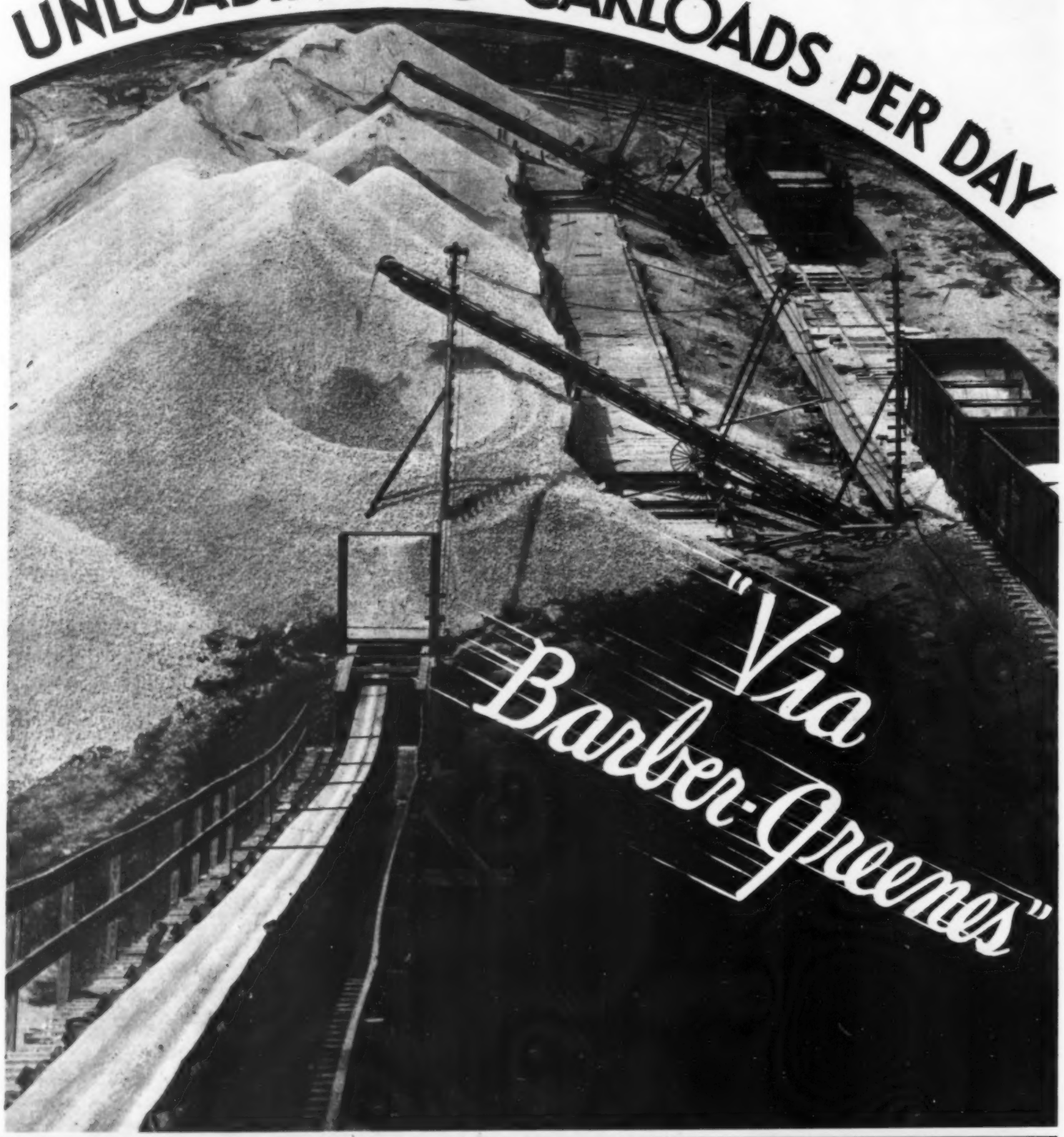


BOTH...STANDARD LAY AND WISSCOLAY PREFORMED.

Wickwire Spencer manufactures all sizes and types of Wire Rope in standard lays and preformed. Wisscolay preformed wire rope will often solve a wire rope application difficulty. Ask our engineers where and when it should be used. Send for a free WIRE ROPE BOOK. It will prove of great value.



UNLOADING 40 CARLOADS PER DAY



THIS is one of the many Barber-Greene installations where ingenuity of layout greatly enhances the value of the machines. The two B-G Portable Belt Conveyors, which unload the cars and store the material, are mounted on auxiliary trucks. These trucks run on industrial track parallel to the switch track—thus facilitating easy movement of the conveyors along the unloading section.

Sand and two sizes of stone are stored, and the permanent conveyor shown on the left receives the desired material through a series of gates beneath the pile. Material is unloaded by the two Barber-Greenes at the rate of 40 carloads per day.

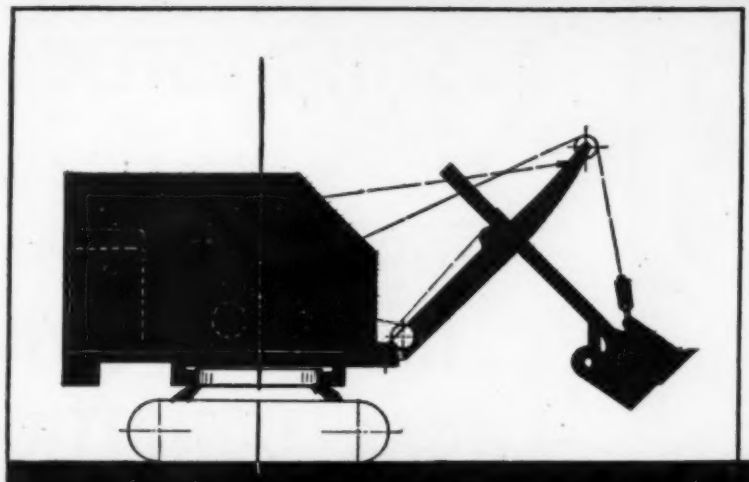
Why not consult Barber-Greene about your next job? We not only give you the finest equipment—but in addition, we offer you the benefit of years of experience in solving and simplifying material handling problems.

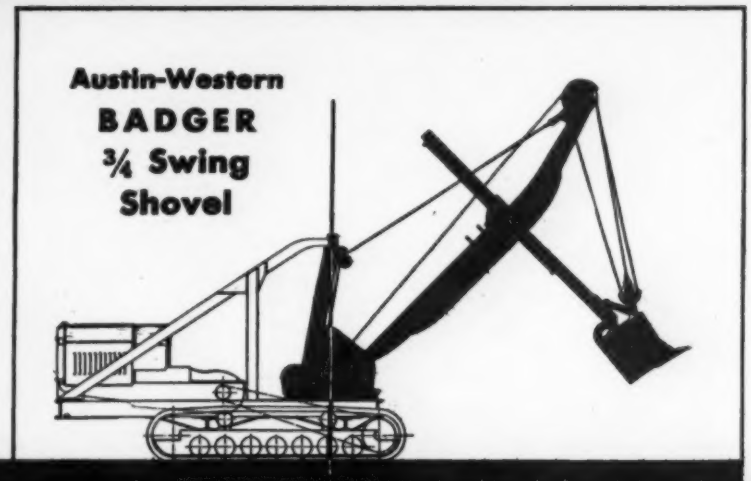
Standardized Material Handling Machines

BARBER GREENE

AURORA, ILLINOIS

LET YOUR JUDGMENT TELL YOU





PARTS IN BLACK SHOW MASS MOVED ON EVERY SWING

—Which is faster?

● Your eye will tell you in the above comparison of shovel designs that a far greater weight must be moved in the one on the left. This becomes an extra load to be controlled as the boom swings. Do you recognize the handicap on speed? First, the extra weight must be put in motion. Then, after a quarter, half, or three-quarter swing in a second or two of time, it must be brought to a full stop.

The Austin-Western Badger Shovel has hung up an enviable record of more buckets per hour—*more yards*—than larger heavier shovels because of its design. The boom alone, supported and pivoted on an "A" frame, swings like the arm from the shoulder, without moving the whole body. There is less weight to move, less to stop.

Considering this variation of shovel design, you will find a majority of your jobs better suited to this faster, lighter type—the Austin-Western Badger. Many other advantages will be discovered—Time saved through faster transportation—Fuel and oil saved through economical operating cost—Greater flexibility on the job. Send coupon below for details.

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Home Office: Aurora, Illinois Cable Address: AWCO, Aurora

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The Austin-Western Road Machinery Co.
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Please send descriptive bulletin on the Austin-Western Badger.

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Wins COUNTRY W

Hewitt-Judd Co., Yakima, Washington, used 3 Austin-Western No. 77 Sr. Dual 4 wheel Drive Motor Graders on jobs in Benton County, Hanford and on Blewett Pass Roads. Mr. R. W. Judd writes: "Your machines gave satisfaction through the season."

The Cherry Valley Turnpike near Syracuse, N. Y., offers entirely different conditions for the "77" of the Wm. P. McDonald Construction Co. of Flushing, N. Y.

The
AUSTIN-WESTERN 77
Earns Its Way by Meeting
Every Variation of . . .
CLIMATE · GRADE
LOCAL CONDITIONS
and MATERIAL

Check these COST FIGURES:

The Hewitt-Judd Company, Yakima, Washington, reports operating costs on the "77" shown above:

Gasoline: Blewett Pass job, grade better than 2½%—2.7 gals. per hour. Benton County job, grade level, soil sandy—2.3 gals. per hour.

Oil: Changed every 60 hours of work. No additions between changes.

Grease: Estimate 1 lb. per day.

Road Mix per 8-hour day: Hanford job, in October with medium temperatures averaged .9 mile on an 18-foot road, 2-inch compacted mat.

Depreciation: Usually figure ⅓ on all equipment. Believe 25% sufficient for these machines.

● One significant test of a road machine is its ability to surpass the common experience of users in widely different localities. We are quoting and illustrating here the highly satisfactory work of Austin-Western 77's in New York, Arkansas, Washington and California. In practically every case users hit upon the same words to express their satisfaction—saying "We are more than pleased."

Obviously "more than pleased" means superiority in certain details when it comes from a hilly section of Arkansas—and certain other superiorities when the report is made on operation in the sandy soil of California.

This is only one phase of the "77's" versatility. One job in New York state will be highway maintenance or construction of shoulders while the next from Washington may prove to be scarifying or oil mix work. It can be seen that "more than pleased" covers a great range of satisfactory performance.

Be sure you know the full range of the Austin-Western 77's capacity, ability and economy. Send the coupon.

The Austin-Western Road Machinery Co.
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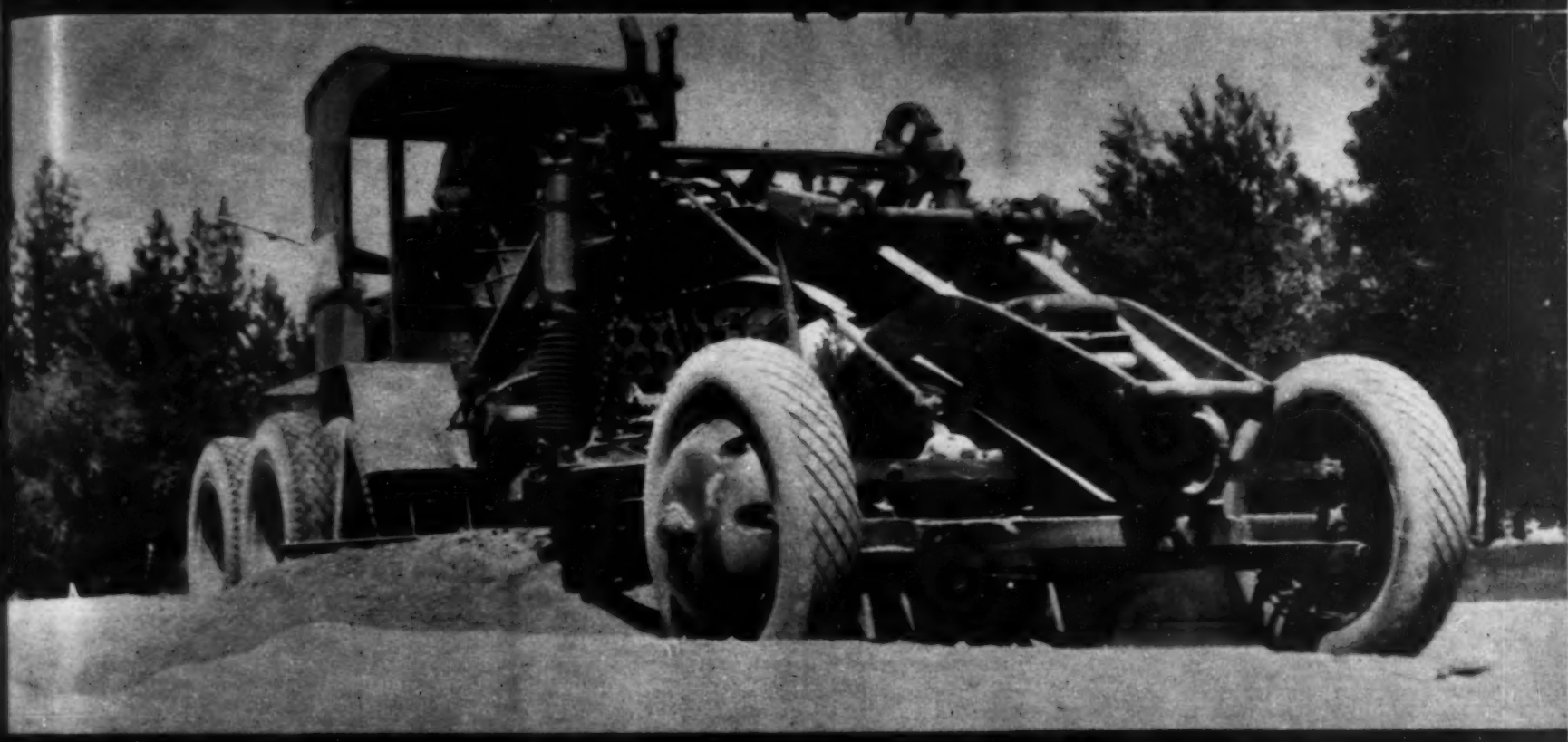
IDE PREFERENCE



"I am more than pleased with results obtained by Austin-Western Motor Graders" writes Jack A. Casson of Haywood, California. The illustration above shows the Grader in sandy California soil.

From Tulsa, Oklahoma, the Rucks-Brandt Construction Corporation writes "We are more than pleased with the performance of this unit." Used on 37 miles of state road in Arkansas.

Below a view of the Hewitt Judd "77's" and another "77" tearing up hard surface paved road in a Washington town.

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ROAD ROLLERS

Austin-Western

DUMP WAGONS

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The Austin-Western Road Machinery Co.
A-6, Aurora, Illinois
Please tell me more about the Austin-Western "77" Motor Graders.

Name.....

Address.....

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CONSTRUCTION men today seldom let anything stop a job's progress. Zero weather, ice, snow, sleet, freezing and thawing—these used to mean an end to concrete placing. But today you mix, place and cure concrete under any weather conditions—and it is *good* concrete.

With the sound methods and job kinks that today's construction men know and use, you do not often need advice. But when there are special problems—when some particular concrete question nearly has you "snowed under"—then, if any of the information we have collected on cement and concrete will help you figure out the answer, we'd like to be called upon to furnish it. Write, phone or wire any of the offices listed below and you will be given cheerful and prompt service. No charge, of course, it's a regular part of every barrel of Universal Atlas cement you buy to make good concrete.

UNIVERSAL ATLAS CEMENT CO.

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Construction Methods

NRA CODE

ROBERT K. TOMLIN, Editor

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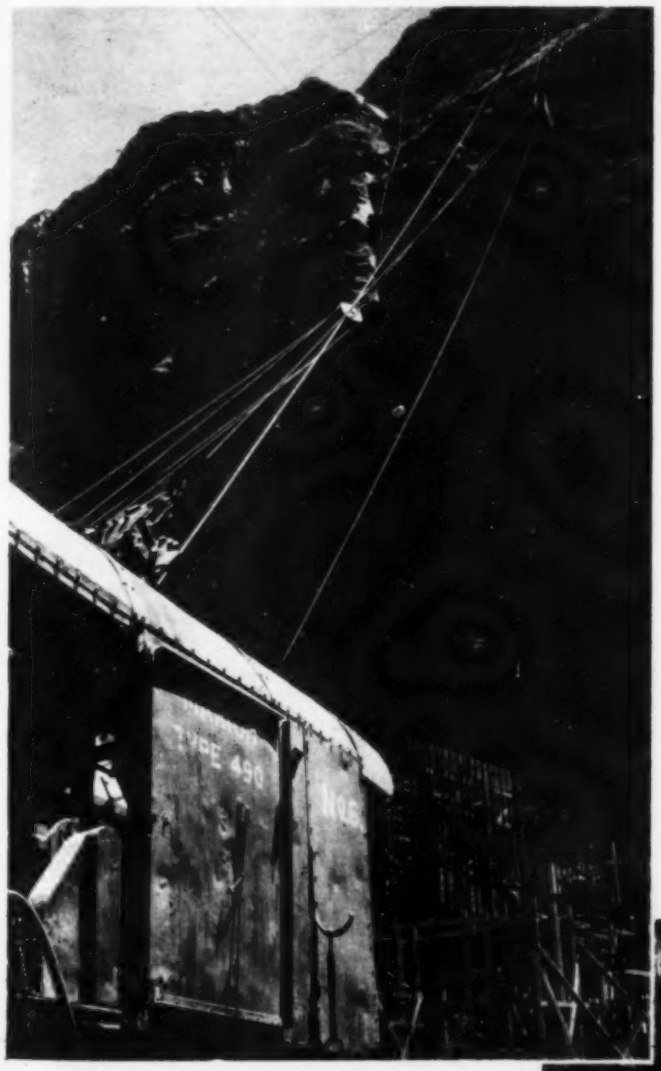


POWER-HOUSE CONSTRUCTION on downstream side of Boulder Dam showing in left foreground power shovel operating the cableway delivering load of reinforcing steel.

A Boulder Dam Construction Kink

Power Shovel Operates Cableway

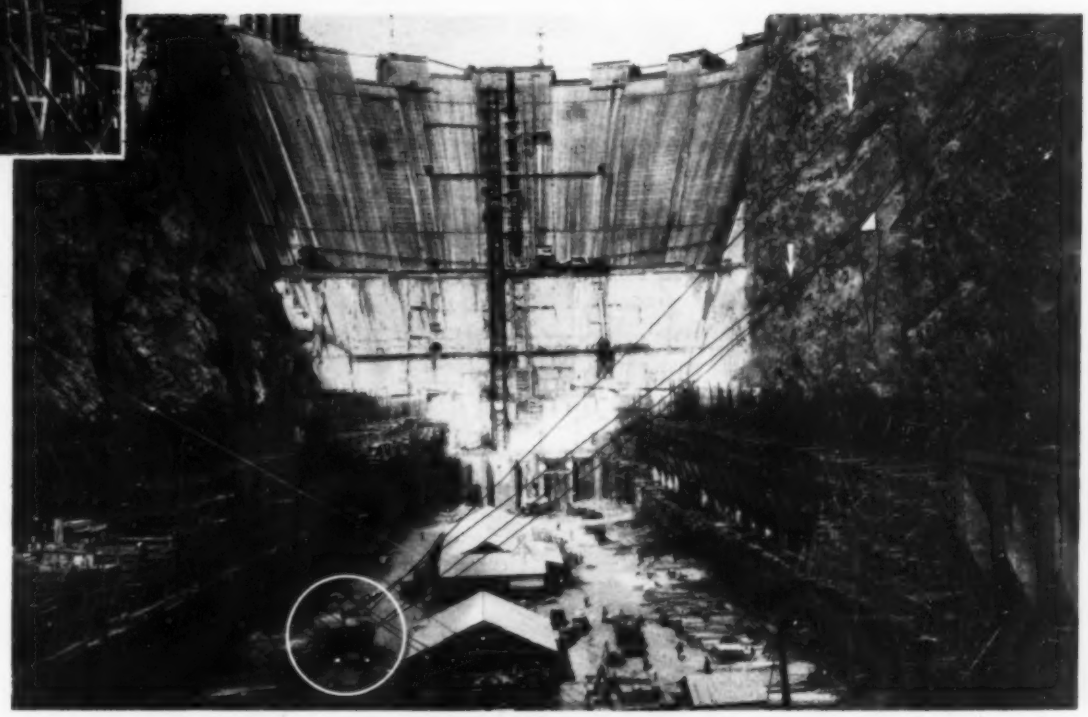
A 490 Marion electric shovel has been pressed into service for unusual duty at Boulder Dam. Mounted on crawlers, it moves to and fro along the canyon bottom in the tailrace below the dam and by means of cables to a point high up on the canyon wall above, delivers materials and equipment from the canyon floor to the power house on the Arizona side. The arrangement is simple, effective and inexpensive.

The ordinary location for the shovel is about 300 ft. out from the base of the canyon wall and it can move along the canyon bottom for about 400 ft., which is its pick-up range. The span of the cable to the anchorage high up on the almost perpendicular wall is about 600 ft. This affords ample range of flexibility for delivering steel, form lumber and practically all materials for power-house construction except concrete. (Concrete is delivered from an entirely independent overhead cableway spanning the canyon.)

Instead of having a fixed anchorage on the canyon wall, the tailbleck of the shovel-operated cableway is in a carriage which can be moved along its supporting bridle to give further flexibility to the delivery system. This tailblock carriage was arranged for operation with only a single line by placing one end of its supporting bridle at a higher elevation than the other, the incline allowing gravity to take the place of a return line. With this arrangement a single line pulls the carriage up the incline as required or, on being slacked away, allows it to move down to the desired position. This line is an auxiliary on the shovel and is operated by a separate single-drum hoist mounted on the shovel deck.

The main track cable from the shovel to the tailblock is a double line, one of whose terminals is dead-ended on top of the shovel. Passing around a sheave in the tailblock this line returns to a four-part tackle on top of the shovel, operated as a take-up by the boom hoist. Riding the double track cable is a four-wheel carriage operated by a line from the hoisting drum and using a gravity return. The fall block is operated by a line from the drag drum. The capacity is 7 to 8 tons. The general scheme of arrangement is shown in the accompanying pictures.

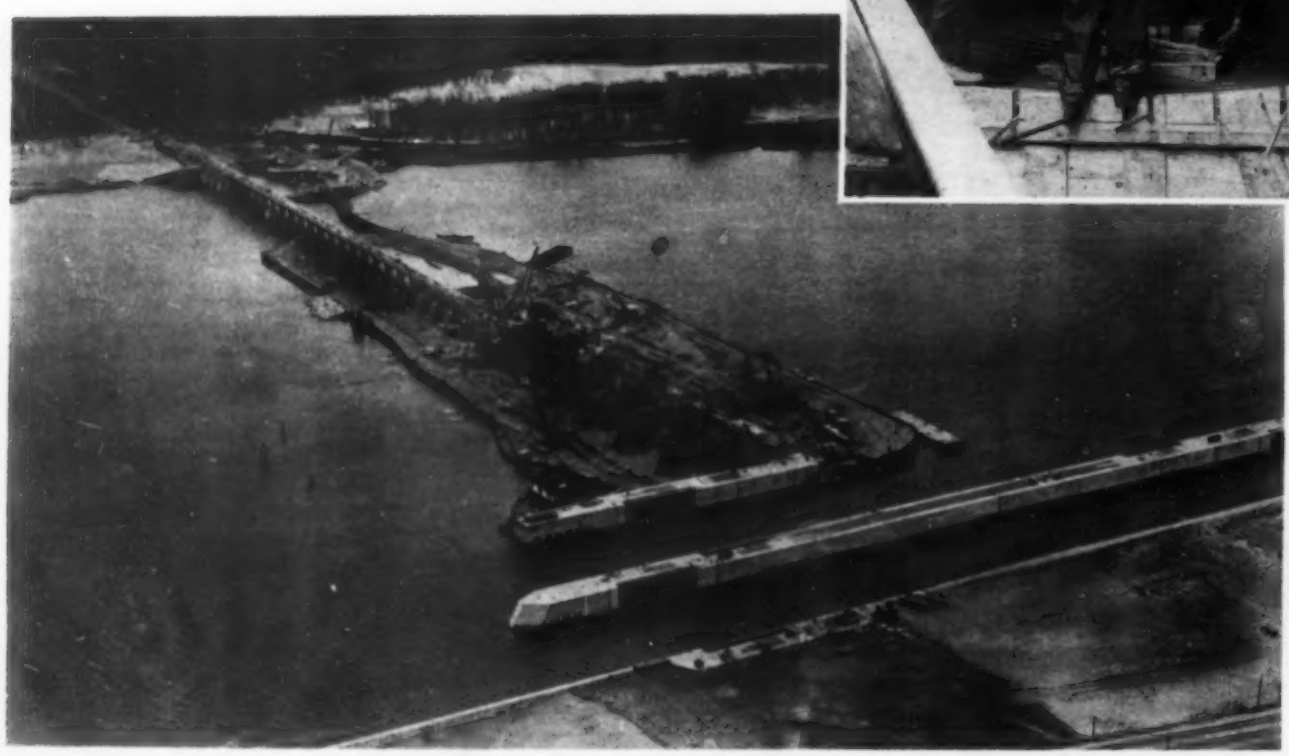
Because of the limited width of the canyon floor, it was not found feasible to use a similar arrangement for the Nevada wing of the power house. This wing was served by a fixed longitudinal cableway, anchored to the dam at the upstream end and to the rock over the valve house at the downstream end.



CABLE ARRANGEMENT above shovel. Three of the four operating lines appear in this view. The fourth is an addition to standard shovel equipment.

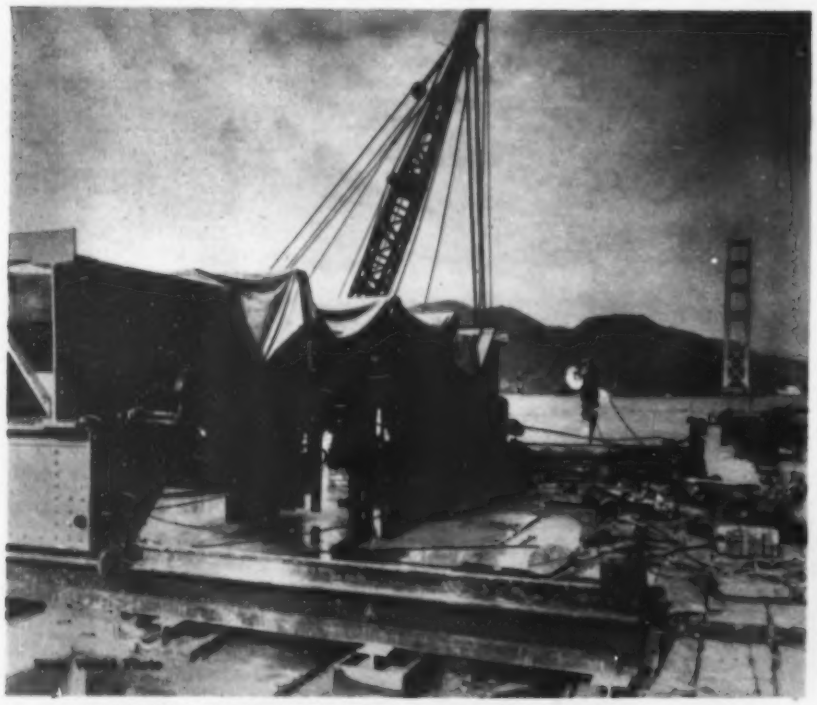
This Month's

"NEWS REEL"

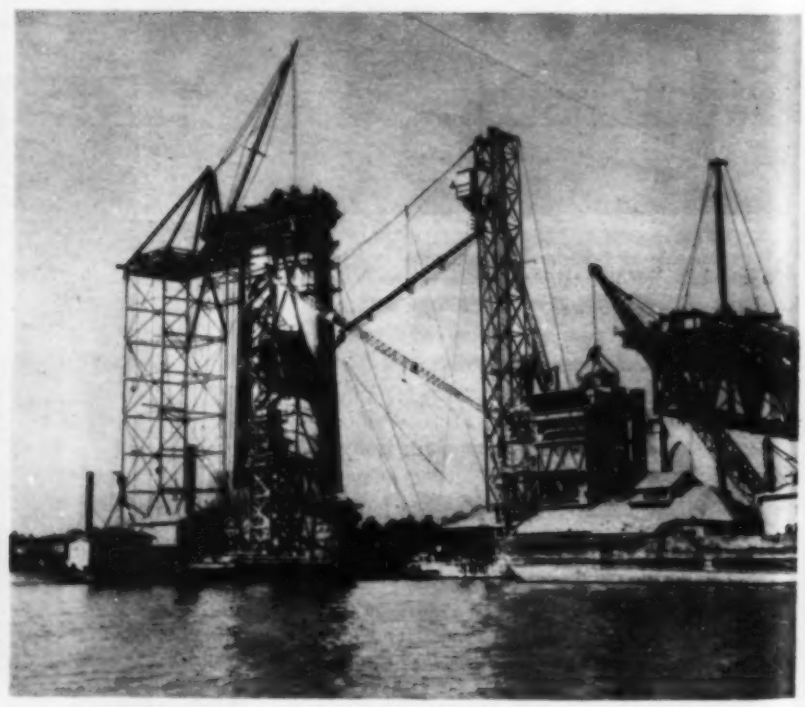


MINNEAPOLIS - ST. PAUL SEWER CONSTRUCTION PROJECT, to which PWA has allotted $16,095,000, reaches active stage following award of number of interceptor tunnel contracts valued at nearly $500,000 each. Reinforced-concrete sewer construction is being carried forward in timbered tunnel.

MISSISSIPPI RIVER DAM NO. 5 *(left)* at Minneiska, Minn., being built by Merritt-Chapman & Whitney Corp., of Duluth, under contract valued at $1,792,198, connects with wall of locks constructed by E. E. Gillen Co., of Milwaukee, for contract price of $783,528. Work is directed by U. S. Engineer Office, St. Paul, Minn.



GOLDEN GATE BRIDGE PIER to support tower at San Francisco end of 4,200-ft. suspension span receives top treatment with mobile grinding machine mounted on traveling structural bridge. Surface is ground to true horizontal plane before base slabs of tower are set.



LAST BUCKET OF CONCRETE IN NEW ORLEANS BRIDGE SUBSTRUCTURE goes into place at top of fourth main river pier which rises from 170 ft. below to 145 ft. above mean low water. Bridge is being built jointly by State of Louisiana and Public Belt Railroad Commission to carry both highway and railway traffic. Siems-Helmers, Inc., is contractor for piers.

TO PREVENT FURTHER EROSION OF SOIL *(right)* on hundreds of acres of valuable farming and orchard land in Las Pasas area near Santa Paula, Calif., U. S. Soil Erosion Service engages in cooperative campaign with farmers of this district. Ditches and terraces on slopes help to prevent washing of soil. YOUNG MEN FROM C.C.C. CAMP *(in oval, below)* operate McCormick-Deering diesel tractor and Adams leaning-wheel grader on hillside ditching.

BORROW FOR 900,000-YD. FILL to carry Grand Central Parkway across meadows in Queens County, New York City, *(right)* is taken out of one pit consisting principally of old dump. Because of ease of digging and loading light-weight material, Arthur A. Johnson Corp. equips Lorain shovel of 1½-yd. designed capacity with 2-yd. plate dipper. Special Euclid truck has capacity of 14 cu.yd. water-level measure or 17 cu.yd. rounded measure. Average load of 15 cu.yd. of borrow weighs 10½ tons.

MORRIS DAM *(left)* on San Gabriel River, recently completed to augment water supply of Pasadena, Calif., is concrete gravity structure 328 ft. high containing 450,000 cu.yd. of concrete, designed to resist earthquake shock. Concrete-lined spillway equipped with three automatic floating-drum-type gates, 70 ft. long and 18 ft. high, (at left) is designed to discharge 80,000 sec.-ft. Dam, which cost $4,750,000, was designed and constructed under direction of S. B. Morris, chief engineer of Pasadena Water Department. Contractors were Bent Bros., Winston Bros., and Wm. C. Crowell, with L. T. Grider as general superintendent.

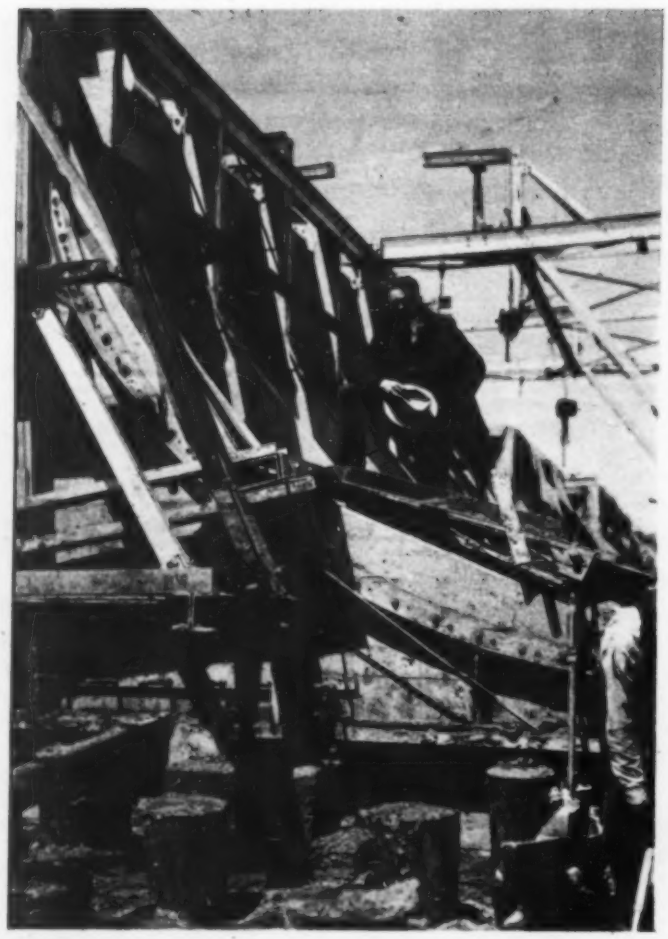
TWO LINES OF WELL-POINTS, one on each side of trench, and low sand dike reinforced with sand bags facing ocean permit construction in dry 5½ ft. below high tide for seawall almost 2 miles long at Fort Monroe, Va.

WELL POINTS

Eliminate Need for Cofferdam on Seawall Project

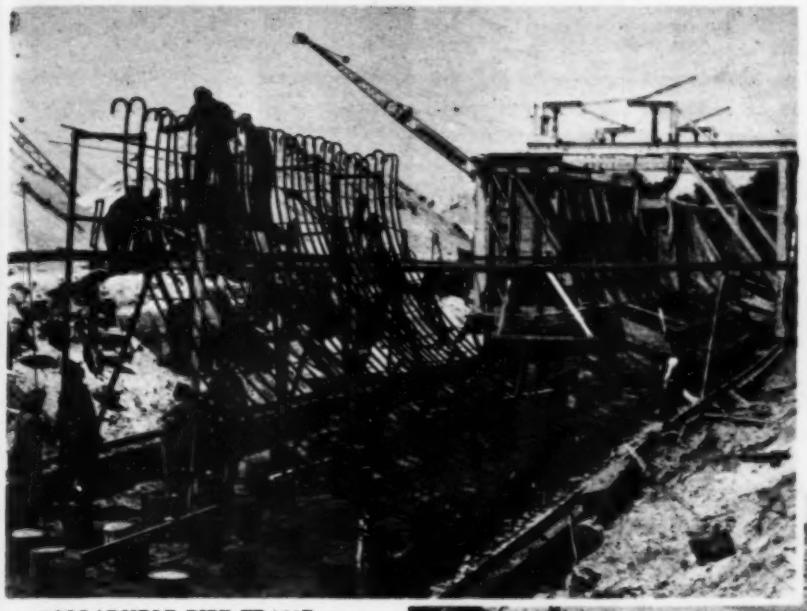
DRYING OUT a seaside trench to 5½ ft. below high tide with a battery of 200 well-points and operating a traveling eight-lead piledriver which hammered down wood piles to support its own track, the Merritt-Chapman & McLean Corp., of Baltimore, Md., built 8,980 lin.ft. of reinforced-concrete seawall at Fort Monroe, Va., for the Corps of Engineers, U.S. Army, at an average rate of 60 lin.ft. per day, mixing and placing 250 cu.yd. of concrete for this length of wall in 10 hr. with a mobile paving mixer having a 33-ft. inclined boom suspended in a gantry A-frame. The contractor carried out all operations of excavating, piledriving, concreting, and backfilling in a distance of 600 to 800 ft., keeping this length of trench dry with two lines of well-points, which eliminated expensive cofferdamming. Movable steel forms for 30-ft. sections of the concrete wall were transported by a gantry on the rails laid for the piledriver.

Seawall Design — Extending north almost 2 mi. from a connection with an existing seawall in front of old Fort Monroe, the new wall protects a long spit of sand from easterly storms sweeping in through the mouth of Chesapeake Bay. The wall has a gravity section (with a curved front to deflect waves) resting on a wood-pile foundation. As shown by the accompanying drawing, the design includes a steel sheetpile cutoff wall, riprap fill at the toe of the reinforced-concrete seawall and a paved backfill with a tar penetration seal 9 in. thick and 25 ft. wide serving as a roadway. The top of the wall is at El. 13, 10 ft. above high tide, and the bottom is at El. -2.50.



Construction Trench — A low sand dike reinforced where necessary with sand bags protected the construction trench from waves on the sea side. Behind this low dike, on both sides of the trench, the contractor installed lines of Moretrench well-points 20 ft. long. Each line of well-points was connected to a 6-in. header tapped at 2½-ft. intervals for point connections. On the sea side of the trench, well-points ordinarily were spaced 5 ft. apart, but on the land side the interval between

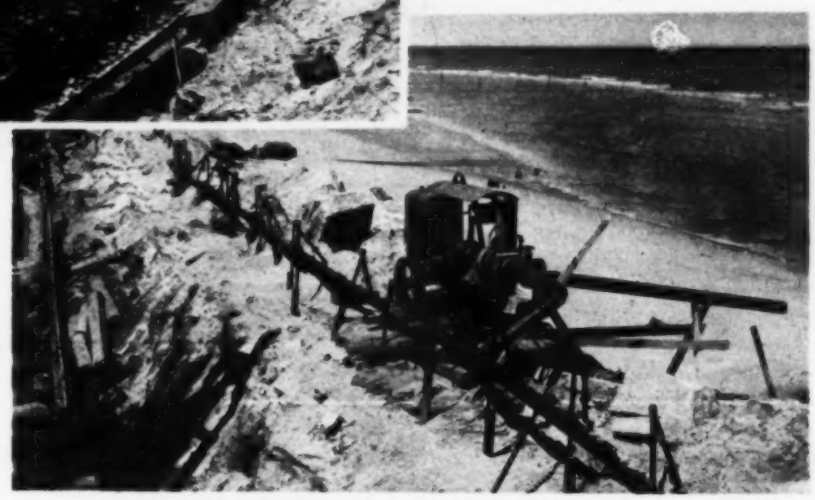
SECTIONAL STEEL FORMS *(left)* for reinforced-concrete seawall are assembled and utilized during first weeks of construction with aid of R. S. Mayo, field representative of Blaw-Knox Co.



COLLAPSIBLE PIPE FRAME supports reinforcing bars for 30-ft. wall section until they can be tied into unit. Rails for traveling piledriver and steel-form gantry are spiked to 12x12-in. timbers resting on wood piles 20 ft. long.

well-points was 10 ft. Two Moretrench 6-in. pumps (one for each header), driven by four-cylinder gasoline engines, gathered water from the pipes and discharged it over the low dike into the sea. A third pump was kept on hand as a reserve unit and was also used to unwater the trench when stormy weather caused a break in the dike. Breaks of this kind occurred occasionally, but the trench was quickly unwatered and restored to working condition after a storm had subsided.

With the well-point system in operation, the constructors had no difficulty in holding the water level at an elevation more than 5½ ft. below high tide. By using well-points to keep the trench dry, the contractor avoided the expense of building steel sheetpile cofferdams, which seemed to offer the most feasible alternative method. This saving probably made possible the successful low bid.



HIGH-VACUUM 6-IN. PUMPS drain water from well-points through 6-in. header pipes. On sea side of trench well-points are connected to header at 5-ft. intervals.

Excavation—Backing away from its work, a Marion steam crane excavated the construction trench close to final grade and about 24 ft. wide with a 1½-yd. dragline bucket, piling the sand on the land side of the trench for later use as backfill. The spoil bank was placed far enough from the trench to leave space for a plank roadway to be used by the paving mixer and batch trucks.

Piledriver—An old derrick chassis provided the base for the multi-lead piledriver. This base, 37 ft. long and mounted on flanged wheels set for 20-ft. track gage, carried four pairs of leads for driving 25-ft. foundation piles and one pair of leads for driving 25-ft. sheetpiles. A revolving Erie steam crane resting on the piledriver platform handled piles and hammers and supplied steam for driving. Channel guides attached to the steam hammer provided a fifth position for this unit in driving timber piles. The channel guides traveled on facing timbers of adjacent pairs of leads.

At the forward end of the piledriver platform was a 17-ft. cantilevered extension carrying two pairs of timber leads at opposite corners for driving the wood piles which supported the rails of the 20-ft.-gage track. The track piles were 20 ft. long and were driven on 10-ft. centers. Rails were spiked to 12x12-in. timbers, 20-ft. long spliced with 4x12x48-in. cap plates on the piles at all splices.

Foundation piles to support the seawall and steel sheetpiles in the cutoff wall were driven with a McKiernan-Terry steam hammer. When putting down foundation piles the piledriver, while stationed in one position, drove the four wood piles in one row across the trench and then moved ahead to drive the odd pile indicated by accompanying photographs. The piledriver was able to install 100 piles in 10 hr., including steel sheetpiles.

Reinforcing Steel—Each 30-ft. block of seawall required about 1½ tons of reinforcing steel. Collapsible pipe frames supported the reinforcing bars during erection until they could be tied into a unit. After they had been wired in position, the bars were self-supporting, and the collapsible pipe frame was removed.

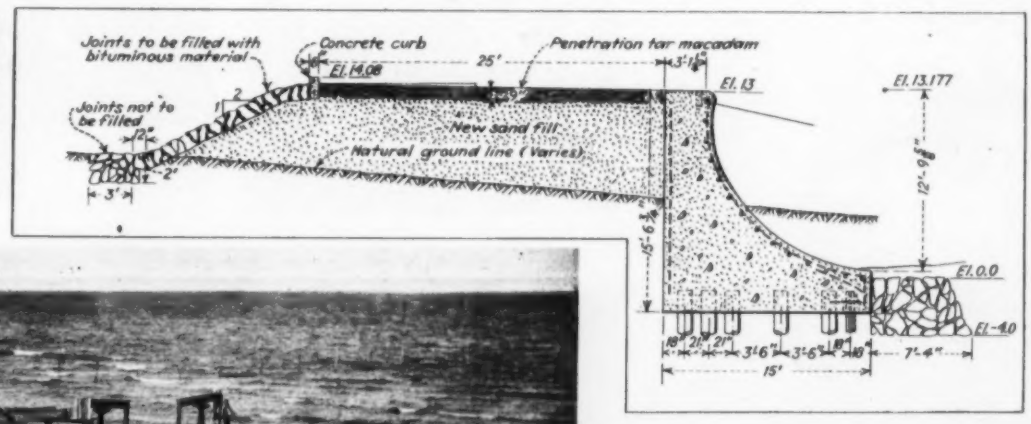
Steel Forms—Four Blaw-Knox steel forms for casting 30-ft. wall sections were utilized by the contractor. Two of these form units served in construction of alternate blocks, and the remaining two took care of the intermediate closure sections. A traveling gantry, which rolled on the same rails used by the piledriver, picked up and moved the form sections ahead.

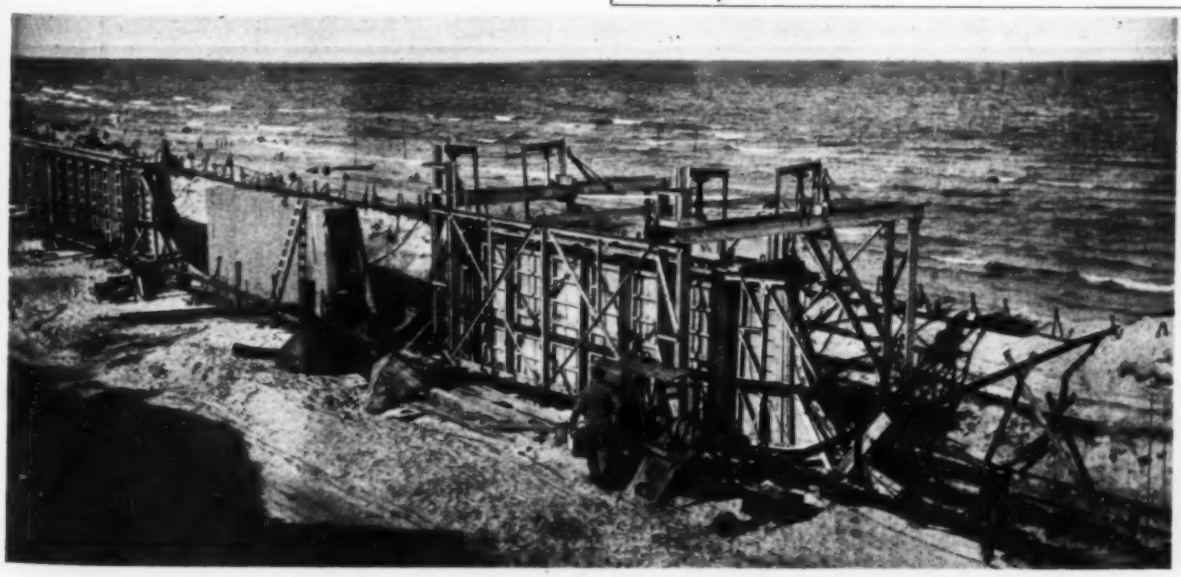
When set in position for concreting, the forms were blocked against the track rails and were tied down at the toe to the steel cutoff wall to prevent uplift. The forms for the alternate wall sections were equipped with hinged bulkheads to pass the forms over sections of concrete wall already cast.

During the first few weeks of concreting, about 7 hr. was required to strike, move and erect a steel form section. This time later was reduced to 5 hr. for a bulkhead form and to less than 5 hr. for a closure form.

Concreting—To build the seawall, a Smith 27-E paving mixer was equipped with a special 33-ft. boom carrying

CROSS-SECTION *(right)* of seawall resting on timber piles, protected by riprap at toe and at rear of backfill. Tar penetration surface seals fill and provides paved roadway.





MOBILE GANTRY traveling on steel rails transports steel form unit for 30-ft. block of seawall from one set-up to next. Forms for alternate blocks have hinged end bulkheads.

a bucket made wider and shallower for this job. A gantry frame to support the boom when carrying a loaded bucket was designed with jack legs which clamped to the steel rail of the construction track. Guy lines from the gantry frame were also clamped to this rail. The bucket delivered concrete to a hopper with two outlets which fed the concrete through elephant-trunk spouts to quarter points inside the form, thus saving on the amount of hand shoveling required. Prior to concreting, roofing paper was laid on the subgrade to prevent loss of water from the mixture into the dry sand.

Specifications required a 1½-min. mix, and the batch-meter on the mixer was set at 90 sec. A 125½-yd. monolithic pour in one 30-ft. wall section required 4 hr., 45 min. The contractor employed two 5-hr. shifts per day, completing two 30-ft. wall sections in 10 hr.

Sand and gravel were batched at a commercial plant in Hampton, several miles from the work, and were trucked to the site. On their way into the job, the trucks stopped under the overhead bin of a Butler bulk-cement plant set up on a railroad siding.

Supplemental Work — At the north end of the reinforced-concrete seawall the contract called for 670 lin.ft. of steel sheetpile bulkhead (⅜-in. steel thickness, arch-web section) running in an east and west direction. The west end of this bulkhead connected with a timber return wall constructed previously by CWA labor. These supplemental bulkheads protected the flank of the seawall at its exposed northern extremity.

In front of the steel sheetpile wall the design called for a blanket of riprap 14 ft. high and two riprap groins 100 ft. long. On the land side of the steel wall, the backfill was paved with a bituminous penetration surface and protected with a riprap shoulder in the same way as behind the concrete wall.

Backfill and Paving—Backfill behind the concrete and steel walls required about 60,000 cu.yd. of sand. Riprap in front of the walls and on the slopes of the sand fill behind them amounted in all to about 28,000 tons.

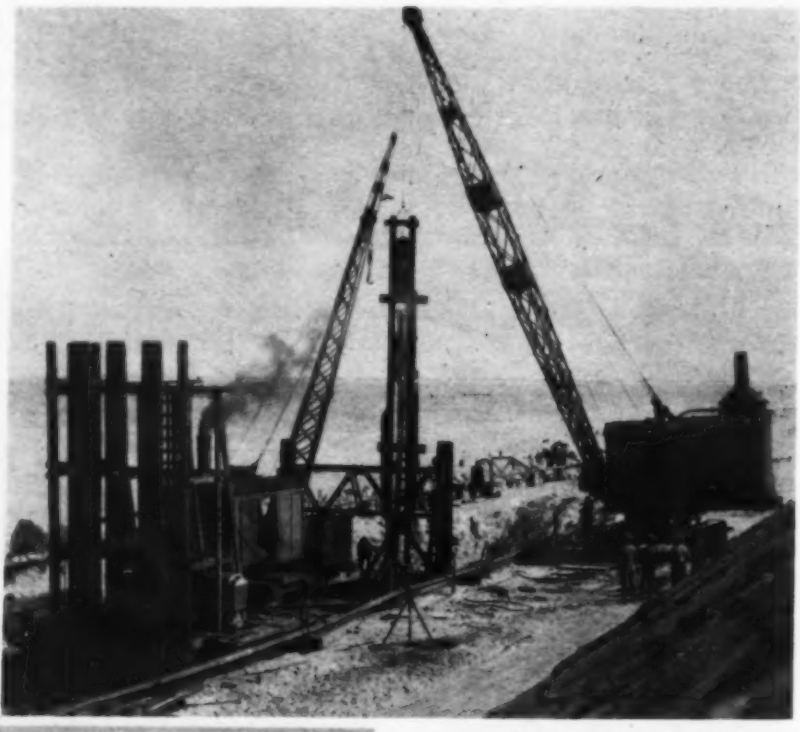
A Wiley steam whirler crane traveling on rails behind the concrete wall excavated the trench at the toe, placed the riprap and sand fill on the sea side and also placed the bulk of the backfill on the land side, using material from the spoil bank and additional sand brought in from the beach to the north by trucks. Auxiliary crawler cranes trimmed the backfill to profile and placed the riprap revetment on the back slope. Riprap stone was shipped into the job by rail and was unloaded by cranes into trucks. Construction of the tar penetration surface on the sand backfill was described in *Construction Methods,* January, 1935, p. 62.

Progress — Construction of the seawall required the driving of 11,230 wood piles and 5,510 steel sheetpiles and the placing of 37,600 cu.yd. of concrete. The contract was awarded January 30, 1934, at a bid price of $867,125.20 and notice to proceed with the work was given to the contractor on Feb. 9, 1934. A contract time limit of 360 calendar working days was specified, with allowance made for days on which the land batteries were engaged in target practice. The date of completion was Feb. 3, 1935. During the month of August, the contractor made the exceptional record of completing in 27 working days 1,620 lin.ft. of seawall.

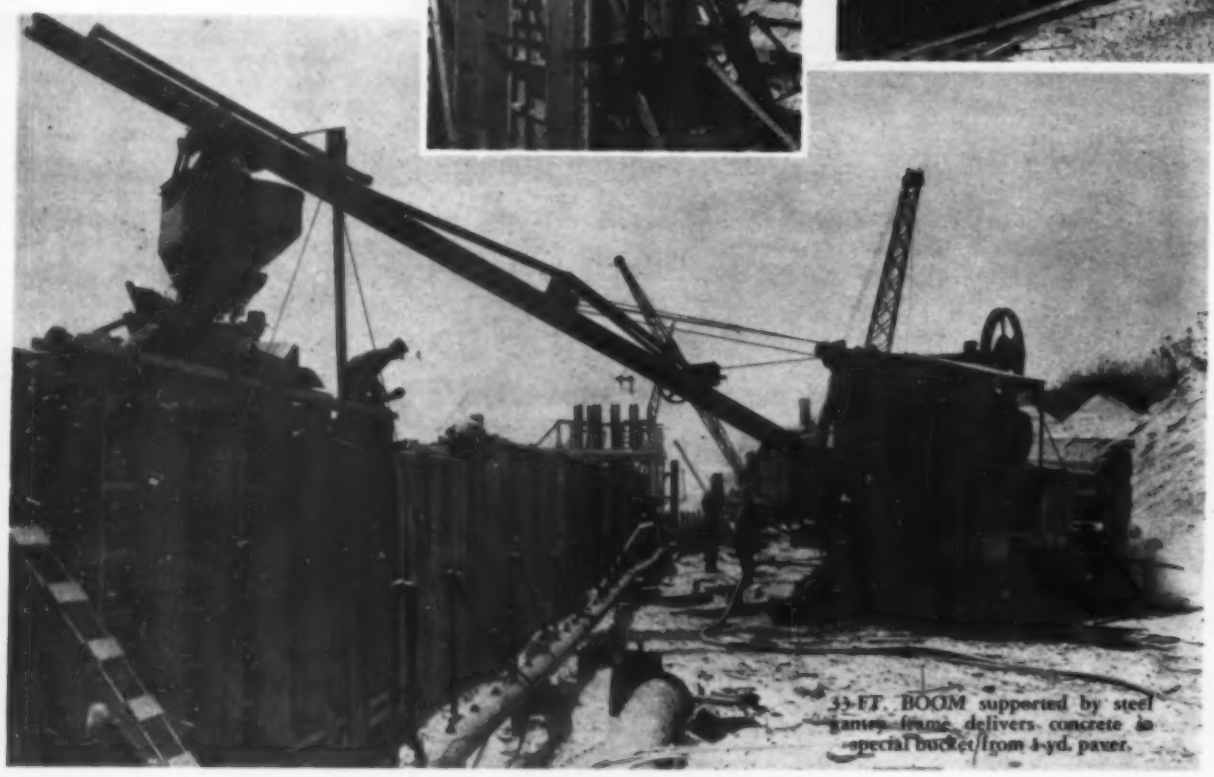
Personnel—A PWA allotment to the Corps of Engineers, U.S. Army, provided the funds for the construction of the seawall. The wall was designed and constructed by the U.S. District Engineer Office, Norfolk, Va., under the direction of Major G. R. Young, district engineer with Captain M. J. Noyes as chief of operations division. In July, after the transfer of Major Young, Captain Noyes became district engineer, later reverting to chief of operations division when Col. E. D. Peek became district engineer in September, 1934. F. E. Johnston, associate engineer, was in immediate charge of construction, and L. E. Bozarth, chief inspector, was resident on the project. For the contractor, the Merritt-Chapman & McLean Corp., of Baltimore, Grover C. Denny was superintendent in charge of the work, with Edward P. Coblentz as engineer and W. R. Maul as clerk of works.

L. E. BOZARTH (left), chief inspector on project for U.S. Engineers, and GROVER C. DENNY, superintendent for Merritt-Chapman & McLean Corp.

JACKS AND CHAIN BLOCKS pick up steel form unit on traveling gantry for movement to next wall section.



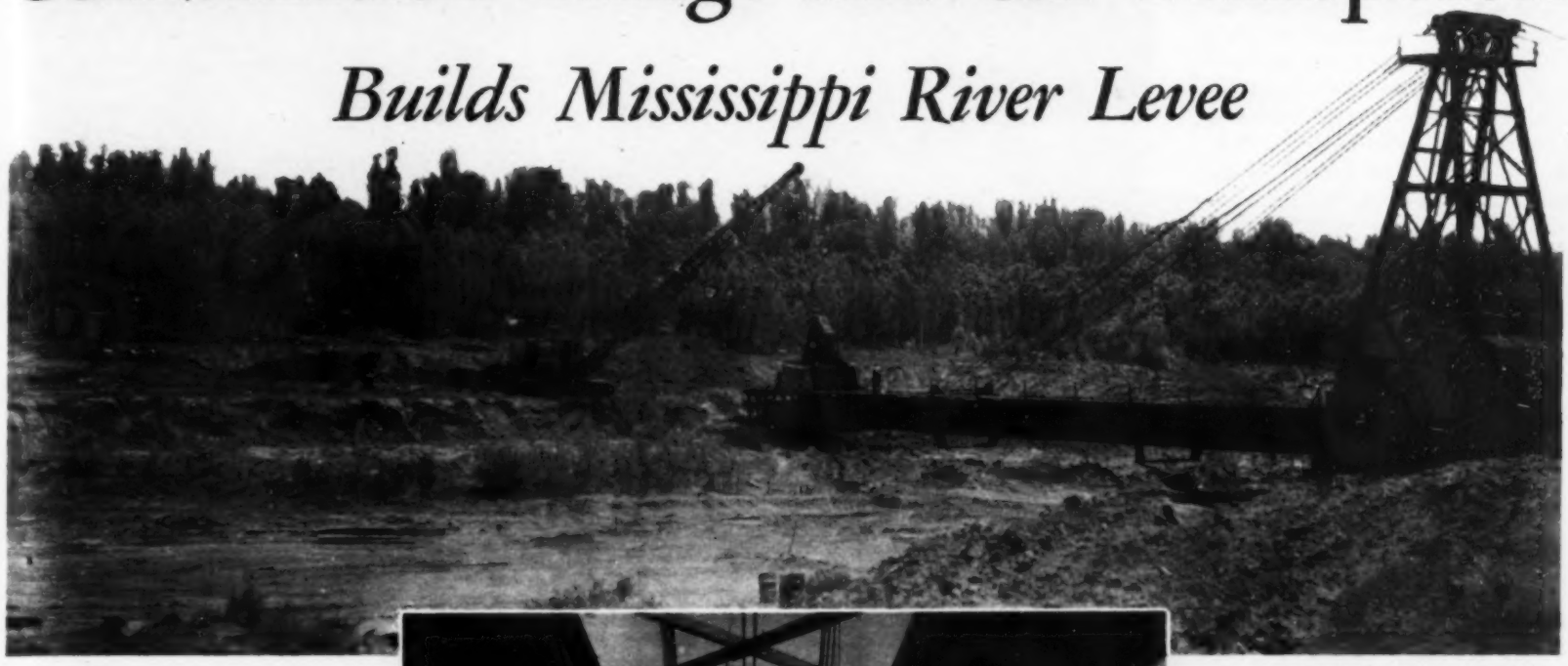
TRAVELING MULTI-LEAD PILE-DRIVER has four sets of leads at near end for driving five lines of foundation piles, one of five being driven with hammer in offset position. Immediately behind these leads is another set for driving steel sheetpiles in cutoff wall. At forward end, piledriver carries two pairs of leads for track-support piles. Revolving steam crane on unit handles piles and operates hammer. Large crane on bank is driving extra-length piles in soft spot with swinging leads.



33-FT. BOOM supported by steel gantry frame delivers concrete in special bucket from 4-yd. paver.

Combination Bridge and Car Transporter

Builds Mississippi River Levee



TRANSPORTER BRIDGE on Mississippi River levee contract handles 7,800 cu.yd. in 24 hr. Tandem draglines working in conjunction with bridge reach material as much as 600 ft. from embankment. Ordinarily both draglines dump directly into hopper.

UNDERSIDE OF LOADING WING. Rails which carry transporter car can be seen.

A MOBILE structural-steel transporter bridge with a total length of 372½ ft., made up of two hinged wings extending substantially equal distances from opposite sides of a central A-frame supporting tower mounted on crawlers, placed a large portion of 2,500,000 yd. of material handled by the Lewis-Chambers Construction Co., Inc., of New Orleans, general contractor for 3,966,000 yd. of levee construction in the Laconia Circle Levee District between the Mississippi and White Rivers in Arkansas, about 120 miles below Memphis. Designed by J. T. Chambers, vice-president of the contracting concern, with the assistance of W. Lehman, chief engineer of the Bucyrus-Erie Co., and built at the latter company's South Milwaukee plant, the Chambers bridge, as the equipment is known, had demonstrated its ability to handle wet, sticky clay and track over soft ground on two previous contracts before it was transported by barges to Laconia. The entire unit weighs 278 tons.

Records of the Lewis-Chambers organization show that the bridge can compete successfully on a cost basis with draglines in comparatively long-distance transportation of large quantities of material. Power and control equipment are located in the tower. Various clutches at the operator's position, which commands a clear view of all operations, control the raising and lowering of the two ends of the bridge, the movement of the entire machine, and the operation of a 10-cu.yd. car which carries material from an automatic loading hopper at one end to any desired dumping point on the other end. The car is propelled by a cable wound on drums driven by the main engine, a 150-hp. Worthington diesel requiring 100 to 120 gal. of fuel per 24 hr. An electric solenoid operated by a switch at the operator's hand controls dumping of the car. The device is so arranged that the car cannot be dumped on the loading side of the machine. An indicator in front of the operator showing at all times the exact location of the car has proved decidedly useful in fogs.

A crew of four, in addition to a foreman, operates the Chambers bridge, which works three 8-hr. shifts per day. The car hauls about 9 cu.yd. per trip on cycles averaging 50 sec., although cycles have been made in 42 sec. Up to last fall, peak production on the Laconia contract was 7,840 yd. placed in the levee in 24 hr. Height of the Laconia levee ranged from 17 to 32 ft. In general, the material was a sandy loam, with stiff clay encountered in some places.

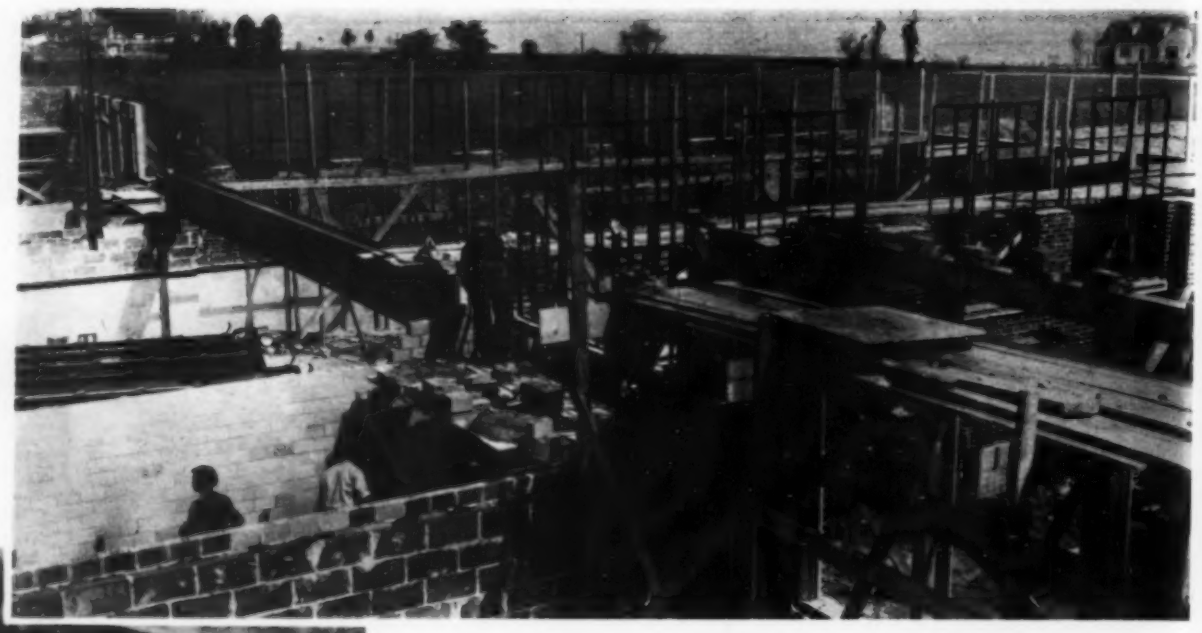
Ordinarily two Bucyrus-Erie diesel draglines, of 2-yd. and 3-yd. capacity, fed the loading hopper on the bridge. Occasionally a 6-yd. oil-burning, truck-mounted dragline with a 175-ft. aluminum boom did the feeding. In either case, the Chambers bridge was able to handle the full output of the excavators without delay to them.

TWO LONG ARMS of transporter bridge are operated and controlled from mobile A-frame tower at about center of unit. Hoist cables from tower top raise and lower two wings independently. Dragline charges hopper under which 10-yd. transporter car is loaded automatically.

FIRE-RESISTANT CONSTRUCTION

Characterizes Modern Rural High School

PROTECTION against the fire hazard is an outstanding characteristic of the design of a county high school recently completed by J. W. Davis, contractor, of Newport News, at Tappahannock, Va., from plans prepared by the architect of the State Department of Education. The structure is typical of a number of modern schools designed by this department. In addition to utility, economy, and good appearance, the architects insist upon safety, sanitation, and comfort.



FIRE-RESISTANT CONSTRUCTION *(right)* **of twelve-room high school in rural Virginia county employs solid brick load-bearing exterior walls and cinder-block interior walls and partitions, some of which are lined with salt-glazed brick tile. Auditorium windows have steel sash.**

COPPER FLASHING built into brick wall above steel lintel over wood frame of classroom windows protects lintel from moisture.

With the exception of some combustible materials in floors, doors, windows and roof sheathing, the entire structure is composed of fireproof or fire-resistant materials. The design provides twelve rooms and an auditorium in a simple two-story building employing load-bearing walls of brick or cinder-concrete-block masonry and truss joists to carry the upper floor and the roof. In plan dimensions, the main rectangular portion of the building measures 132 ft. along the front by 59 ft. deep. From the center of the rear wall, an auditorium 42 ft. wide projects an additional 52 ft. The total length of this auditorium, which has a balcony entirely within the main portion of the building, is 77 ft. The only structural steel in the building is employed in the auditorium. Steel framing for the balcony is supported by a 26-in. 85-lb. girder 40 ft. long. A lighter girder of equal length supports the procenium arch. A boiler room 45 ft. by 25 ft. in area under one corner of the building is the only basement.

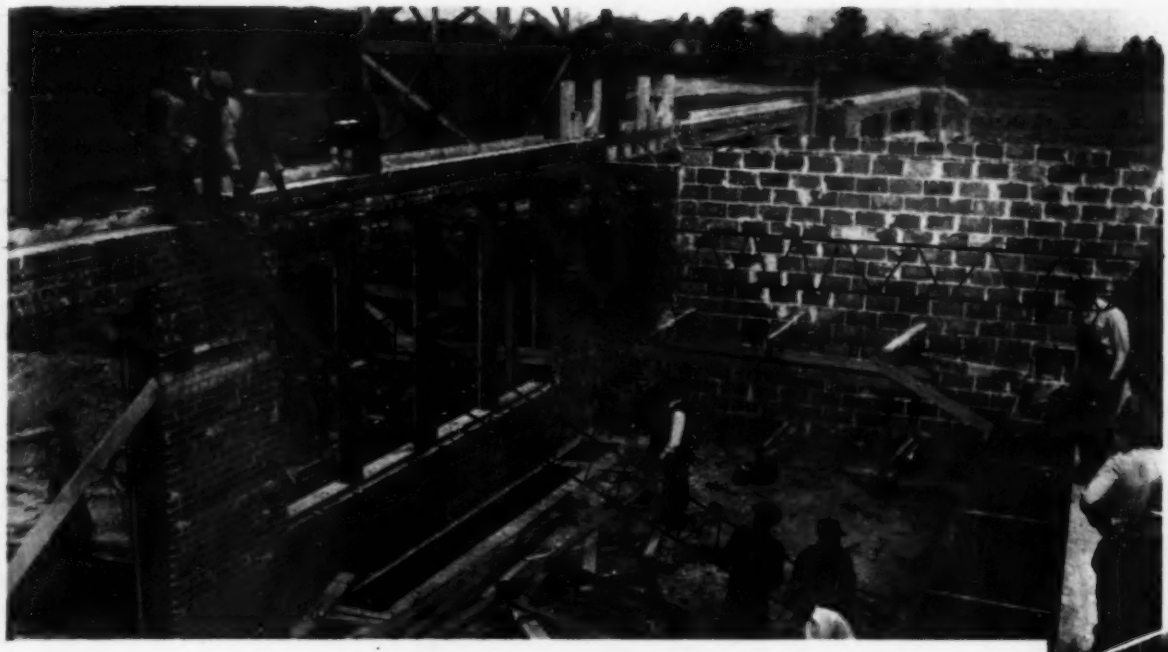
Wall Construction — Footings and foundation walls are concrete. In the superstructure all load-bearing walls are 12 in. thick, and interior partitions have a thickness of 8 in. The exterior walls are solid brick, of shoved joint construction. Interior walls are built up exclusively of cinder-concrete blocks, except where salt-glazed brick tiles were incorporated in these walls to provide a washable surface in corridors, toilets and auditorium. Along the corridors and stairways, a band of salt-glazed brick tile was built into the wall to a height of about 5 ft. above the floor.

WOOD FRAME of classroom windows conceals steel mullions resting on precast concrete sill and steel lintel supporting brick wall above windows.

Exterior walls were sprayed on the inside with two coats of water-proofing before being plastered. Steel window sash were built into these walls at the toilets and auditorium, but wood frames were used at classroom windows and entrance doorways. To carry the wall load above the windows steel supporting frames, concealed by the woodwork, were set into the brick masonry. These frames on the first floor consisted of 6-in. 12-lb. I-section mullions and riveted 3x3x¼x5-in. double-angle lintels. On the second floor the mullions were reduced to 5-in. 10-lb. I-sections and the lintels to 3x3x¼x4-in. double angles. The lintels are protected against moisture by a flashing of 16-oz. copper built into the brick wall above the steel angles. All windows have precast concrete sills on which the mullions bear.

Steel Framing — About 7 tons of structural steel was required for the balcony framing and the proscenium girder in the auditorium. The main balcony girder frames into two short H-

INTERIOR LOAD-BEARING WALL *(right)* **12 in. thick is built up of cinder-concrete blocks except for lining of salt-glazed brick tile along corridor and stairway.**



BAR JOISTS *(left)* supported in brick and cinder - concrete - block walls carry all floors of building's second story.

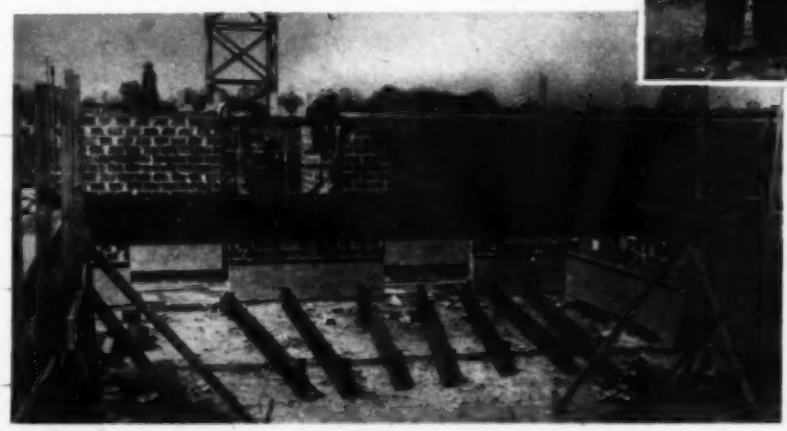
section columns, but the proscenium girder rests on the building walls, as do the upper ends of the inclined balcony girders at the rear of the auditorium. All stairways are steel, with stone treads.

Floors and Roof — Except over the boiler room, the base of the first floor consists of a 4½-in. concrete slab laid on earth subgrade. Bar joists carry all other floors of the building. In the classrooms, where these joists support clear spans of more than 23 ft., the spacing is about 2 ft., c. to c. On top of the joists, the contractor placed 2½-in. concrete slab on heavy copper-bearing metal lath, which served as a form to retain the plastic concrete mixture.

Floor surfaces vary in the different parts of the building. In the vestibule, corridors, toilets, and auditorium, the wearing surface consists of 3/16-in. asphalt tile laid on a finished cement floor. For the floors of the classrooms, library, and laboratory, wood sleepers were set into the concrete slab. On these sleepers, the contractor built up a two-layer wood floor with a top course of maple strips.

Over the main portion of the building, where the spans are 24 ft. or less, the roof is carried on bar joists provided with wood nailing strips to which 1⅛ -in. wood sheathing could be attached. In the auditorium, where the clear span is 40 ft., the roof rests on angle trusses to which 4x6-in. timbers were attached with lag screws. The timbers both stiffen the top chords of the trusses and serve as nailing strips for the wood sheathing. A 20-year built-up roofing was laid on the wood sheathing.

IN CHARGE OF CONSTRUCTION. *(Left to right)* H. E. Calisch, PWA resident engineer - inspector; E. M. Hardy, superintendent for J. W. Davis; and A. H. Eubank, clerk of works, representing Virginia Department of Education and local school board.



40-FT. GIRDER supported at each end by H-section column carries balcony at rear of auditorium.

Cast Stone Trim—Decorative panels above the main entrance, coping on the parapet wall, pilaster caps and other details of the building are cast stone. A cornice of cypress is protected by a wash of 16-oz. copper.

Construction Plant—A typical construction plant for a building of this size and character was installed by the contractor. A 7-cu.ft. mixer batched by wheelbarrows produced 1,100 cu.yd. of concrete required for the foundation and floors. When working on the foundations and first floor, the concrete was distributed directly to the forms by wheel-barrows. For the upper portion of the building, both the concrete and other materials were elevated by a two-barrow platform hoist operated in a wood tower 38 ft. high by a two-drum steam hoist engine.

Masonry construction, aside from the concrete, called for 330,000 brick, 2,700 8x16x12-in. cinder concrete blocks, 2,300 8x16x8-in. concrete blocks, and 35,000 salt-glazed brick tile (of two-brick size), in addition to about 2,500 8x16x6-in. cinder concrete blocks in pipe trenches.

Supervision — Raymond B. Long, architect of the State Department of Education, was in general charge of design and construction. At the job, A. H. Eubank, clerk of works, represented both Mr. Long and the local school board. For J. W. Davis, the contractor, operations were directed by E. M. Hardy, superintendent. H. E. Calisch was resident engineer-inspector for the Public Works Administration, which financed the building, acting under Col. A. A. Anderson, PWA engineer for Virginia.

LOAD - BEARING WALLS AND INTERIOR PARTITIONS *(left)* are built up of brick, cinder-concrete block or salt-glazed brick tile, depending upon location and purpose. Toilets, corridors and auditorium have lining of glazed tile.

Cement on Asphalt Emulsion Provides

LASTING STEEL PROTECTION

TO PROVIDE permanent protection for 120,000 sq.ft. of structural steel at the new Pennsylvania railroad station in Newark, N. J., the construction engineers of the railroad company selected cement on asphalt emulsion as the most economical covering of proved effectiveness. After an inspection of protective coats of this type which had been in service for 7 years or longer, the railroad engineers made an arrangement with J. B. W. Gardiner, owner of the patent on the process, to use the same protection on the structural steel at Newark. By this process a thin shell of cement was locked to the steel surface, affording a protection of cement in addition to that provided by the asphalt emulsion.

Procedure—A heavy coat of asphalt emulsion first was applied to the surface of the steel with a spray gun. The emulsion employed for this coat contained no material which would hold water or would retard its evaporation by sealing over or setting of the surface when brought into contact with an alkali, as happens with soap emulsions. This characteristic of the material assured that the water in the emulsion could be drawn from it freely.

Immediately following the application of asphalt emulsion, before any set of the material could take place, the wet surface of the emulsion was covered with a thin layer of quick-hardening portland cement, blown on dry. The dry cement adhered to the wet emulsion, drawing the water out of it and using this water for its own hydration. Thus the cement and the emulsion set together, with a definite interlocking of the two materials which prevented any spalling or flaking of the cement coat. The cement coat formed a rough, granular surface to which a final cement-and-water slurry coat could bond readily. After a period of 24 hr. or longer, the dry-cement surface was given a heavy coat of cement-and-water slurry, applied with a brush.

PROTECTIVE COATING of cement on asphalt emulsion presents smooth surface of uniform color after final cement-and-water application has dried.

Total thickness of the entire protective coat was less than ⅛ in., the dried emulsion coat being about 1/20 in. thick, and the combined cement coats about 1/16 in. thick. After the slurry application had dried, the protective coat presented an appearance of smooth concrete which was uniform in color.

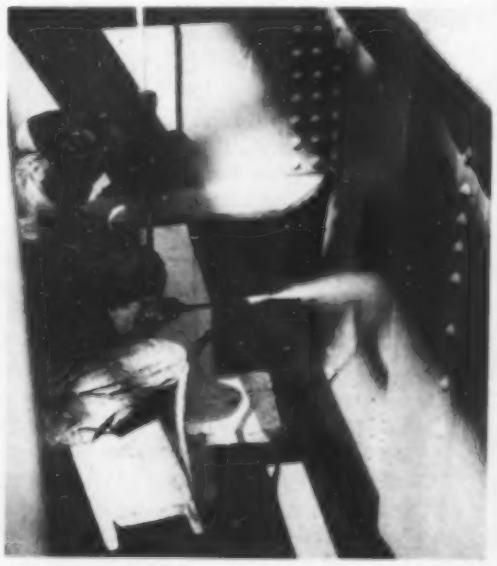
In applying the asphalt emulsion, the contractor used a Stowe multiblaster spray gun. The coat of dry cement applied to the wet emulsion was blown on with a spray gun improvised by J. M. Roeschlaub, who was in charge of the work for the contractor applying the protection. This device consisted of a funnel-shaped can, filled with dry cement and equipped at the bottom with a nozzle to which compressed air was admitted by opening a valve. The photographs illustrate the various steps in applying the protective coating, called Armored Hydralt and based on a special asphalt emulsion known as Hydralt, furnished by J. B. W. Gardiner, Inc.

Specifications — Railroad company specifications applying to the protective coat on the Newark contract are as follows: "The material used shall be a dispersion of asphalt in water, the dispersion being accomplished through the medium of a mineral colloid. No clay or other material forming a jelly with water shall be used in its manufacture. When dry portland cement is sprayed on the freshly applied asphalt dispersion the cement shall wet immediately with no sealing over of the asphalt surface until the body of the coating is dried throughout.

"The material shall be applied in a substantial thickness, covering with a gallon of the material as delivered not in excess of 20 sq.ft. Immediately into the asphalt surface before it has dried there shall be sprinkled, blown or otherwise applied, a covering of dry portland cement from 1/32 to 1/16 in. thick. Incor cement, as made by the International Portland Cement Co., or other approved brand, shall be used for this purpose.

"Not earlier than 24 hr. after the application of the dry portland cement, the surface of the cement shall be given a coat of a wash of cement and water applied in sufficient thickness to conceal completely all granular character of the cement surface."

L. P. Struble is engineer in charge of the entire Newark improvement, including the passenger station, for the Pennsylvania Railroad Co. J. Rich Steers, of New York City, holds a general contract for all the work at Newark. Application of the protective coat was performed by the General Waterproof Products Co., of New York City and New Brunswick, N. J.



ASPHALT EMULSION of special type first is sprayed on structural steel by means of pressure gun at rate of at least 1 gal. to each 20 sq.ft.

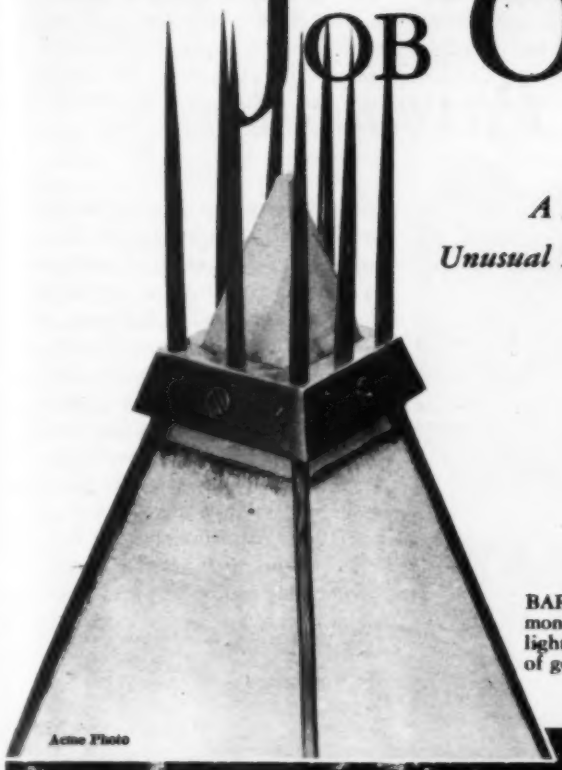
SPRAY GUN FOR DRY CEMENT consists of funnel-shaped can filled with high-early-strength cement feeding pipe nozzle attached to compressed-air hose.

SLURRY COAT of cement and water is applied by brush not earlier than 24 hr. after spraying with dry portland cement.

JOB ODDITIES

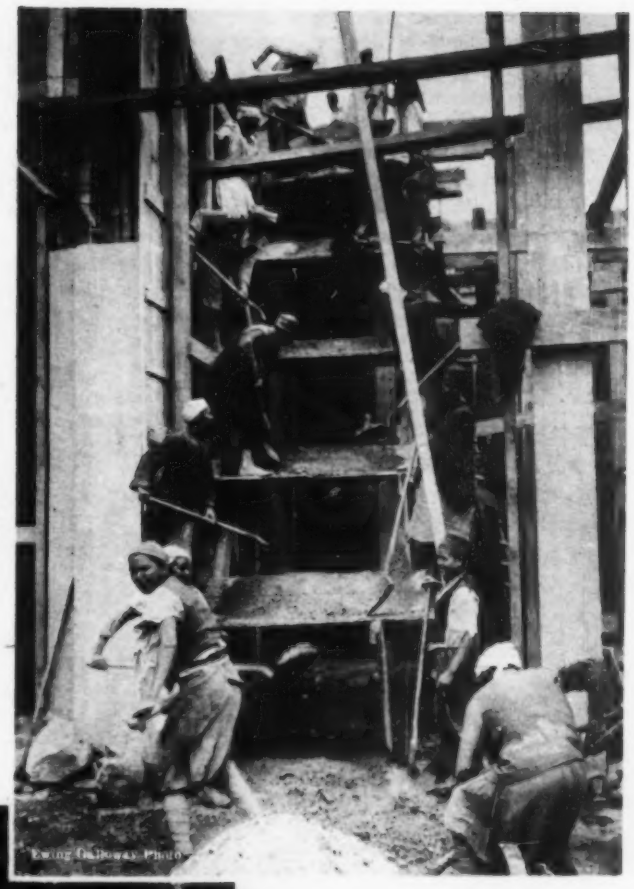
A Monthly Page of

Unusual Features of Construction



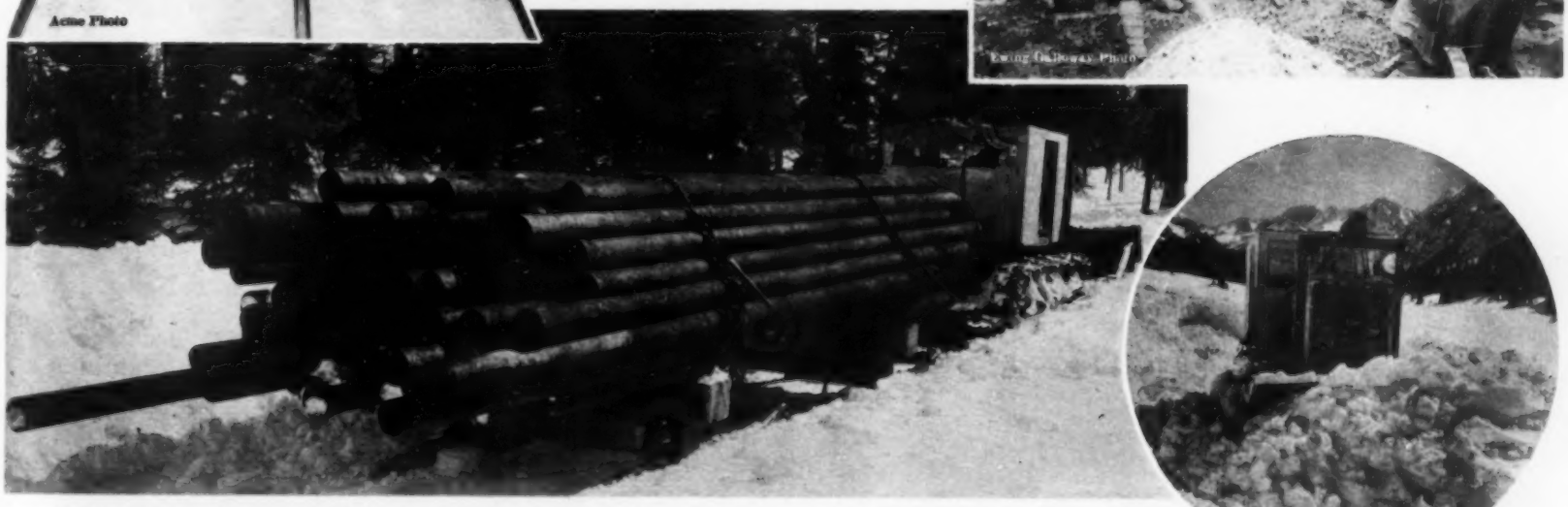
Acme Photo

BARBED TIP *(left)* **of Washington monument protects 550-ft. shaft from lightning. New cap has eight rods, made of gold and platinum, costing $25 each.**



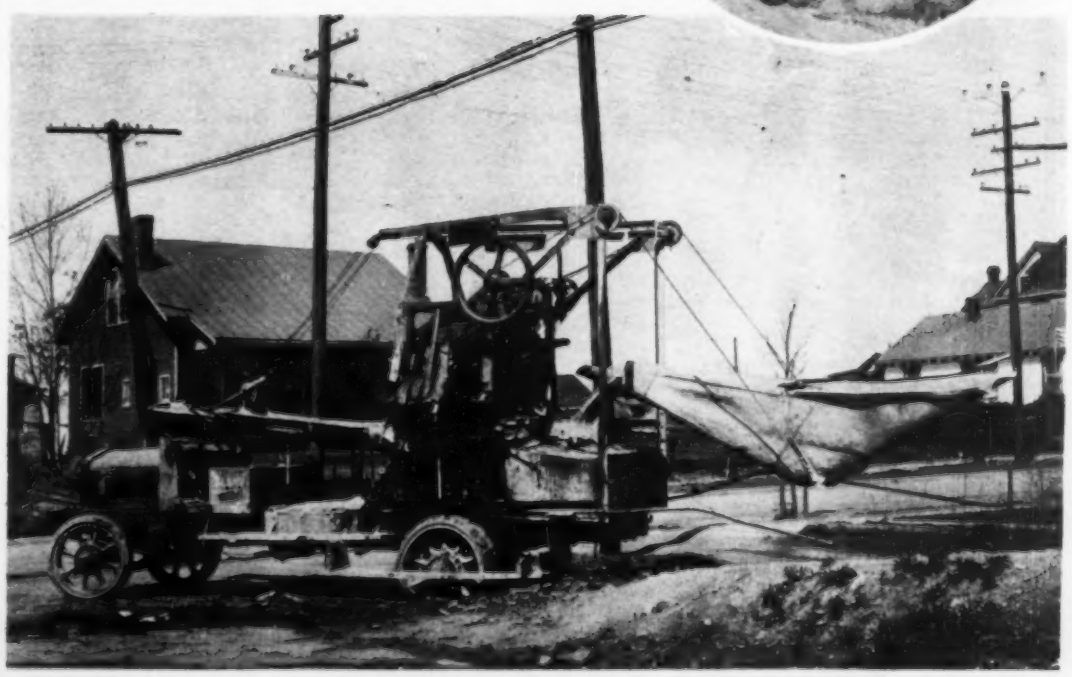
Ewing Galloway Photo

PRIMITIVE CONCRETE ELEVATOR *(right)* **powered by native Moroccan labor raises material from step to step in construction of modern reinforced-concrete building in Casablanca.**



15 TONS OF PIPE for compressed-air line in Twin Lakes water-diversion tunnel is hauled 11 mi. over snow trails from Aspen, Colo., to tunnel at El. 11,500 by 50-hp. Caterpillar diesel tractor equipped with LeTourneau bulldozer which serves to keep trail clear *(in circle)* **of snow up to 5 ft. deep. Tractor is only transportation between Aspen and tunnel. In winter it operates at fuel cost of $1.80 per 8-hr. day. Platt Rogers, Inc., contractor.**

MERIT FLAGS *(left)* **on Coachella Division of Colorado River aqueduct, awarded each month to camps making best safety, progress and economy records, fly in front of commissary at Yellow Canyon camp, marking one of few occasions when single camp gained all three honors at one time.**



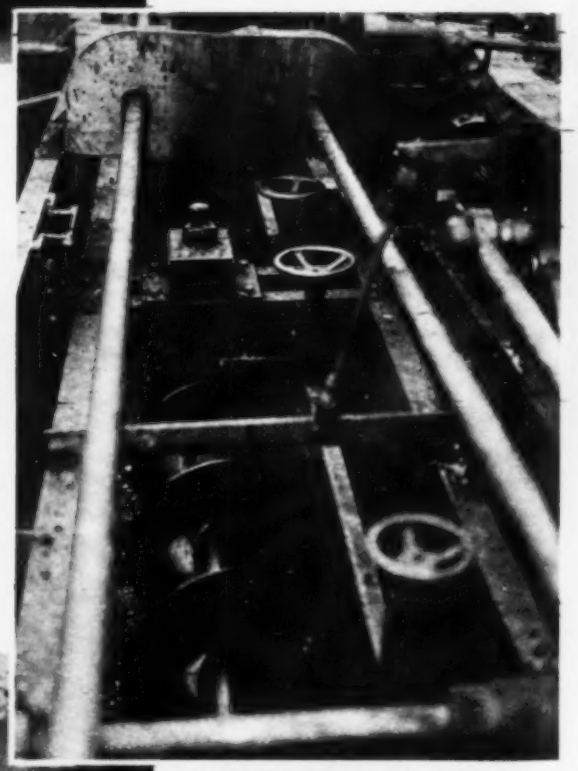
TRUCK-MOUNTED 21-E PAVER rented by Richmond Bridge Corp. mixes superstructure concrete for Cowardin Ave. bowstring arch viaduct constructed with relief labor in Richmond, Va. Mobile plant is readily shifted to convenient locations for concreting various portions of structure.

Combination Spreader and Finisher

Builds Asphaltic Concrete Pavement

COMBINATION SPREADING AND FINISHING MACHINE running on new concrete headers receives truck-hauled asphaltic mixture in dump box which workman is cleaning, distributes material across road and strikes it off to desired depth for rolling. Leveling course to fill depressions in old macadam has been placed. Plate attached to screed of finishing machine struck off this course.

HOT MIXTURE FOR WEARING COURSE of asphaltic concrete pavement is dumped by trucks into receiving box of machine, distributed uniformly across road by spiral screws, and struck off by oscillating screed to proper grade and profile for compaction.



POWER-DRIVEN SPIRAL SCREWS, independently controlled by operator of machine, distribute asphaltic mixture from receiving skip uniformly across pavement in front of screed.

TRUCK DUMPS HOT MIXTURE into receiving skip of self-propelled spreader and finisher as material is required without interrupting progress of machine.

IN ITS FIRST major test (on a project involving 64,000 sq.yd. of two-course hot-mix asphaltic concrete on Ohio state route 11, east of Eaton, Ohio) a combination spreading and finishing machine distributed and struck off to proper grade and profile for compaction by road rollers an average of 340 tons of material per 10-hr. day, covering an area of 1,200 sq.yd. with binder and top course. This yardage of pavement was as much as could be compacted by two rollers under the specifications, and the quantity was about as great as could be produced conveniently by a single asphalt plant. According to the contractor, the C. C. Robinson, Swingle & Robinson, General Construction Co., of Columbus, Ohio, the combination spreader and finisher could have handled almost twice this daily tonnage. At the end of each day's work, the machine was removed from the pavement to permit traffic to use the road during the night. Asphaltic concrete was supplied to the machine by a modern asphalt plant equipped with an efficient dryer which maintained production at close to maximum capacity even with very wet aggregate.

Design of Pavement — Economical design by the Ohio State Department of Highways was a feature of the pavement, which utilized as a base an existing gravel and stone sub-base with an old 4-in. penetration macadam top and warped the grades of concrete base widening strips and headers along the two edges to reduce the amount of asphaltic concrete required in the pavement construction. Divided into two sections, the work involved a total length of 6.525 mi. of 20-ft. pavement,

including two 9-in. concrete headers. To improve the alignment of the old road, the department of highways varied from 1¼ to 6 ft. the width of 6¾-in. thick concrete base widening, with which the 2¼ x 9-in. curb was cast integrally. Warping the curb grades, i.e., building each curb in conformity with the grade of the adjacent edge of the old macadam, caused the curbs to vary in a few places as much as 6 in. in elevation. This variation was found to be excessive, and the maximum permissible irregularity was reduced to about 4 in., which is not noticeable to a traveler driving casually over the road.

On top of the old gravel-macadam base, which had a minimum total depth of 12 in. and a macadam thickness varying from 3 in. to 5½ in., the design called for a 1½-in. binder course and a 1-in. top course of hot-mix asphaltic concrete. Depressions in the existing base were filled by a leveling course of about the same proportions as the binder course. The new pavement has a 2-in. parabolic crown.

Combination Spreader and Finisher—Hot asphaltic concrete for all three courses of the pavement was delivered to the receiving box of a combination spreading and finishing machine by dump trucks which backed up to the box. The skip fed the asphaltic concrete to two transverse screw conveyors, one for each half of the pavement, which distributed the material uniformly across the base under ready observation and control by the operator. A strike-off screed behind the worm distributors struck off the materials to desired grade for compaction by the rollers.

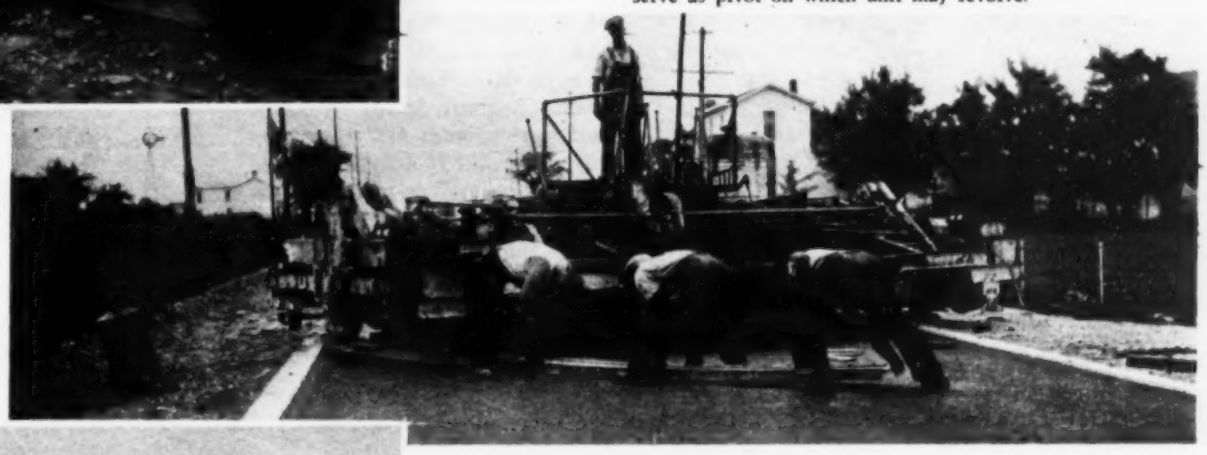
As built by the Jaeger Machine Co., the asphalt paving machine is really a combination of this company's portland-cement concrete spreader (for use in conjunction with truck mixers) and the mechanical road finisher (adaptable to either portland-cement concrete or asphalt construction). The spiral screw distributing device is derived from the former apparatus, and the oscillating strike-off screed is adapted from the standard finishing machine. Only a dump box is added, at the front of the combination unit, to eliminate the use of spreader boxes and dump boards. A gasoline motor operates both screed and screws and propels the combination spreader and finisher along steel road forms or concrete headers.

Operation of Machine—On this project the machine struck off the leveling course and the binder course with an adjustable strike-off plate attached to the screed. Because of the irregularity of the macadam base the screed did not oscillate while striking off the leveling course. The reciprocating motion was employed in striking off the binder course. For the top course the screed itself struck off the material, using the oscillating movement. Compression plates riding on the concrete headers under the two ends of the oscillating screed provided the additional depth of material necessary to allow for compaction under the rollers. At all times the machine ran in lowest gear at a forward speed of about 12 ft. per minute, because this speed was adequate to take care of maximum asphalt production.

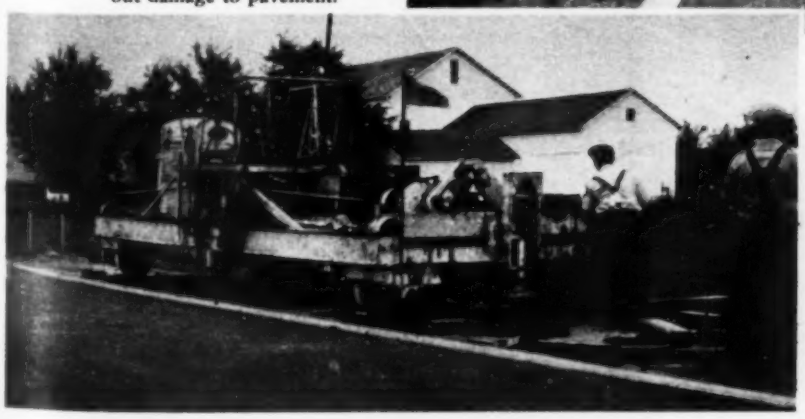
At the end of the day the combination spreader and finisher was pulled back by a roller to the point where work would start the following morning. The workmen then jacked up the ends of the machine, one at a time, to remove the compression dollies and prepare the unit for removal from the pavement. Accompanying photographs illustrate this operation. Under one end was placed a curved track of 10-ft. channel iron upon which the wheels of the machine rested. At the other end the men installed a hydraulic jack which served as a pivot about which the machine revolved until it rested parallel with one

AT END OF DAY, machine is removed from pavement to open road to traffic during night. Workmen jack up machine, one end at a time, to remove compression dollies.

UNDER ONE END OF MACHINE, hydraulic jack is left in place to serve as pivot on which unit may revolve.



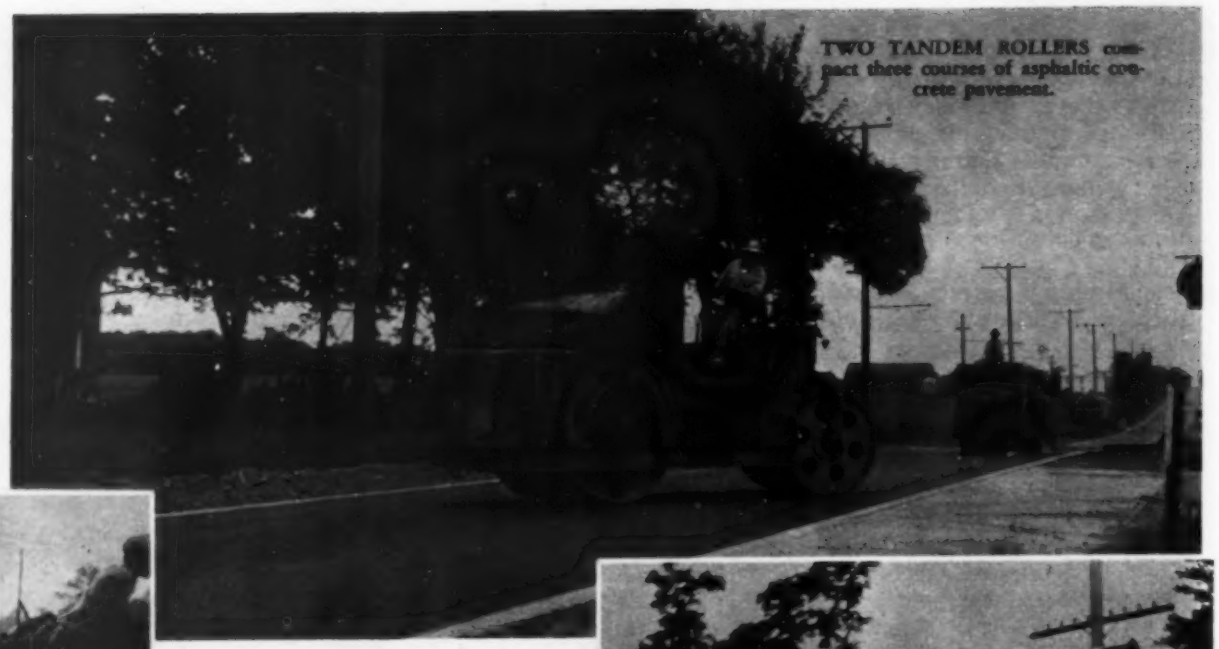
UNDER FREE END OF MACHINE *(right)* workmen place curved steel track on which flanged wheels may travel across road without damage to pavement.



WITH QUARTER TURN COMPLETED, combination spreader-finisher is run back on timbers clear of pavement. Red lanterns protect equipment during night.

curb. From this point it was rolled back on temporary rails laid on the shoulder of the highway, leaving the road clear for night traffic. An ample number of red lanterns marked the position of the machine.

Paving Procedure—On the two sections of the project the contractor laid 18,642 sq.yd. of concrete base widening, with integral curbs, and 63,443 sq.yd. of 2½-in. asphaltic concrete pavement. In addition, the contractor placed a considerable amount of asphaltic concrete leveling course. Concrete for the base widening was mixed and



TWO TANDEM ROLLERS compact three courses of asphaltic concrete pavement.

DIAL PYROMETER connected to thermocouple in hot-sand chute indicates any need for changing volume or ratio of two separate aggregates fed simultaneously from bins to cold elevator.

placed by Jaeger truck mixers, which were charged with dry batches and water at batching plants erected along the berm of the highway at three points within the limits of the job. Ramps 3 or 4 ft. high were erected on the berms of fills, and the batch trucks charged the truck mixers by dumping from these ramps into the mixer drums at a lower level. Batch hauling was done by the same trucks which later transported asphaltic concrete.

These trucks were insulated with ¾-in. Celotex covered by sheet iron. A canvas top was drawn over each load of asphaltic concrete while it was being transported to the job. The insulation of the truck bodies reduced the heat loss to a negligible amount and facilitated dumping of the hot mixtures, as very little material stuck to the bodies. Specifications required that the material be delivered to the road at a temperature between 275 and 350 deg. F. The asphalt plant was located at Camden, adjacent to a commercial crushing, screening and washing plant which supplied the aggregate, 10 mi. from the west end of the project. A temperature drop of 5 deg. was the maximum recorded between the plant and the job. On one warm day, when a breakdown caused a load of asphaltic concrete to be left in a truck for 8 hr., the material suffered a temperature drop of only 25 deg. The contractor used seven 8-cylinder trucks hauling 4 to 5 tons per trip and six larger trucks carrying up to 7 tons each.

On the road, the trucks backed up to the combination spreader and finisher and dumped into the receiving box while the machine was in motion. After a truck had filled the box, it pulled ahead a few feet to wait until the machine was ready to receive another charge.

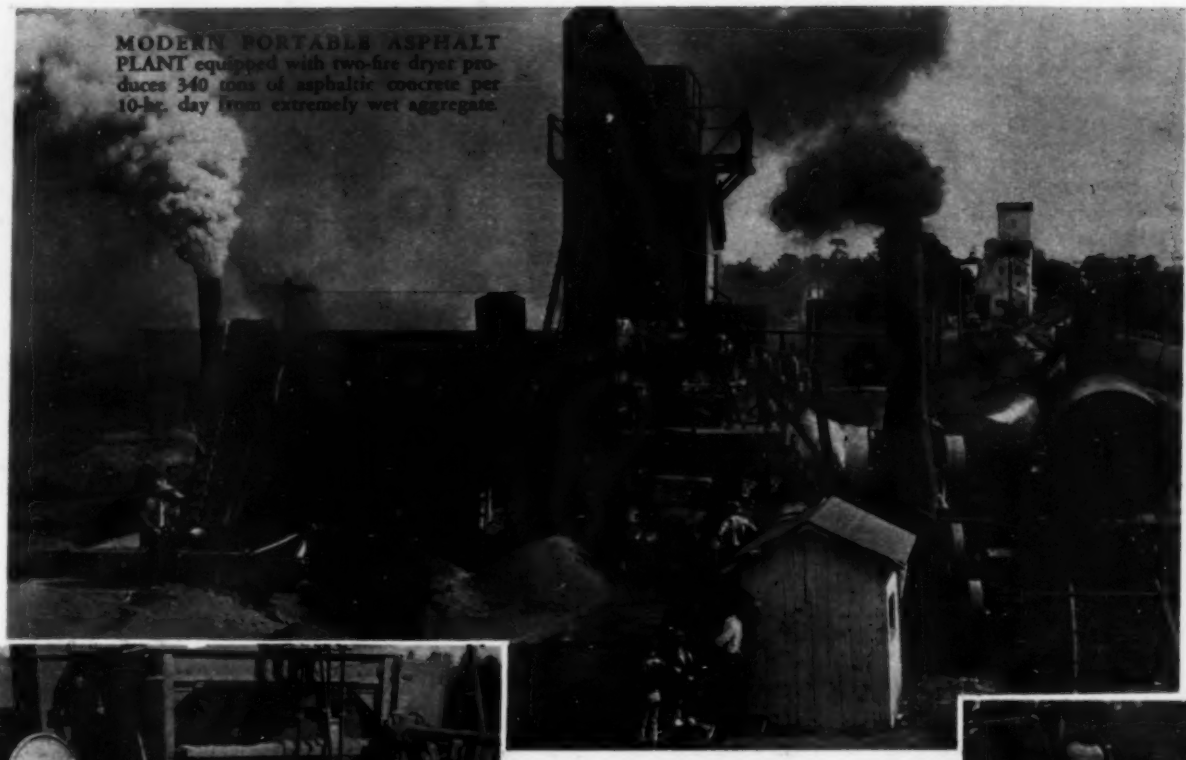
Rolling was carried on in accordance with a specification that required two rollers, weighing 10 to 12 tons, to put in not less than 8 hr. of actual rolling time on each 1,600 sq.yd. of binder course and not less than 8 hr. of actual rolling time on each 1,200 sq.yd. of top course. The contractor worked two 5-hr. shifts per day for six days each week, in keeping with the regulation limiting hours of labor to 30 per week on projects financed under the National Industrial Recovery Act. In effect, the rolling specification limited the amount of pavement which could be constructed in one day, using only two rollers, to about 1,000 lin.ft. In good weather, the organization laid about 1 mi. per week. Within 36 calendar days following the start of asphalt paving operations, the contractor placed 1,500 cu.yd. of leveling material and finished 49,000 sq.yd. of pavement.

CONCRETE BATCH for base widening and integral headers is dumped from truck on overhead ramp directly into drum of truck mixer.

TRUCK MIXER *(left)* traveling on existing macadam road delivers transit-mixed concrete for base widening and header curb.

Asphalt Mixtures—Coarse aggregate used in asphalt mixtures was 100 per cent crushed gravel produced by a plant equipped with a primary jaw crusher and two roll crushers. The wearing-course mixture contained about 7½ per cent bitumen, 40 per cent sand and 52½ percent crushed gravel ranging up to ⅜ in. in size. No filler dust was used in this mixture or in the others; Ohio has used none for 4 years.

For the binder course, the mixture consisted of about 5.2 per cent bitumen, 30 per cent sand, and 64.8 per cent coarse aggregate ranging from ⅜ in. to ¾ in. in size. This mixture also was employed for the leveling course, where the depth was too shallow to permit use of larger aggregate. Where the leveling course was thick,



MODERN PORTABLE ASPHALT PLANT equipped with two-fire dryer produces 340 tons of asphaltic concrete per 10-hr. day from extremely wet aggregate.

MIXER OPERATOR *(left)* weighs aggregates in batch hopper with aid of visual dial scale and asphalt in steam-jacketed stationary bucket by beam scale. Electric interlock controls dry-mix and wet-mix periods in pug mill.

a coarse aggregate ranging from ½ to 1½ in. in size was substituted in a mixture containing a slightly greater proportion of crushed gravel, with correspondingly less asphalt and sand.

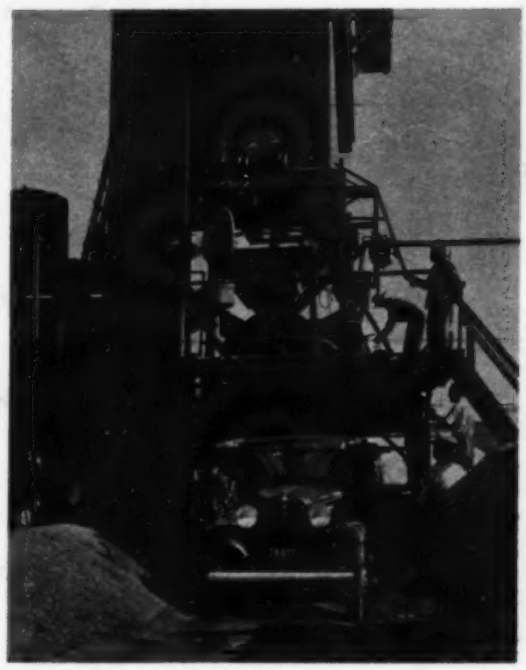
Asphalt Plant—A modern Cummer portable asphalt plant, equipped with a two-fire dryer and improved mechanical details for economical operation produced an average of 340 tons of asphaltic concrete per day. The dryer, which had an external combustion chamber and an internal cumbustion chamber, both fired by Best ¾-in. burners, proved effective in handling the wet aggregate from the nearby washing plant. Although hot mix was required on this project, the plant is so designed that cold mix can be produced without any changes in the equipment. The platform is arranged for one-man operation.

A 60-hp. electric motor drove all the moving parts of the plant, and a 60-hp. locomotive-type portable boiler heated the asphalt cars and an 11,000-gal. storage tank. Specifications called for a mechanical feeder for simultaneous delivery of two separate aggregates to the dryer. The plant was equipped with a reciprocating plate feeder, driven from the cold elevator, which fed sand and coarse aggregate in the proper ratio.

Rotary jackets and screens at the top of the bins separated the combined aggregates after they had been dried and raised to this point by the hot-sand elevator. The bins had four compartments with a total capacity of 40 tons. Both asphalt and aggregate were measured by weight. The plant was equipped with a steam-jacketed stationary bucket for the asphalt and with a dial scale for visually indicating weights of aggregates. When the asphalt bucket discharged, the material was distributed through the full length of the mixer, a 1-ton steam-jacketed pug-mill type, by means of a spray bar. An electrical interlock automatically controlled and correlated the opening of the asphalt bucket, of the weighing hopper and of the mixer gate. This device was set for a dry mixing period of 15 sec., after which it automatically discharged the asphalt through the spray bar into the mixer. At the end of a 45-sec. wet-mix period, the electric interlock automatically opened the mixer gate.

A workman at the cold elevator adjusted the feeder for the amount and ratio of aggregates fed to the dryer in accordance with the reading of a dial pyrometer erected near his working position. The pyrometer dial scale was connected to a thermocouple in the hot-sand chute feeding the hot-sand elevator. By adjusting the gates and division plates at the feeder, the workman held the pyrometer reading between 300 and 400 deg. F. Although the aggregate from the nearby plant was extremely wet, the dryer maintained operation of the asphalt plant at its rated capacity of 350 tons in 10 hr.

IN CHARGE OF WORK. *(Left to right)* C. E. Neff, project engineer, and R. S. Fisher, assistant division engineer, Ohio State Department of Highways; and H. G. Cooper, directing operations for C. C. Robinson, Swingle & Robinson, General Construction Co.



THROUGH DRIVEWAY *(left)* facilitates loading of insulated truck bodies with batches from overhead mixer.

Five men comprised the entire operating force at the asphalt plant. These men were the foreman, the mixer operator, the mechanic, the boiler fireman, and the laborer on aggregate feed. The plant operated under the supervision of C. H. Wuchter, who was in charge of inspection for the Bureau of Tests of the State Highway Department.

Personnel—For the Ohio State Department of Highways operations were supervised directly by Otha Hecathorn, resident engineer for Preble County, and C. E. Neff, project engineer, with the active assistance of their immediate superior, R. S. Fisher, assistant division engineer. Luke Brannon is division engineer. For the entire state highway department, O. W. Merrell is director and H. P. Chapman is assistant director and chief engineer. H. G. Cooper was in charge for the contractor.

3-In. Track Ropes

Erected on Two 1,925-Ft. Cableways at Norris Dam

ERECTION of the two 1,925-ft. span, 18-ton cableways installed as key units in the construction plant at Norris Dam of the Tennessee Valley Authority on the Clinch River in East Tennessee was carried out according to step-by-step methods determined before contracts for their manufacture were awarded. General features of the design and operation of these cableways were described in the November, 1934, issue of Construction Methods, pp. 46-49.

CLAMPING [illegible] CABLE to double [illegible] nections [illegible] sheaves spaced [illegible] on messenger [illegible]

MAIN CABLE REEL *(left)*, showing yokes and swivels on both ends as attached at factory.

MAIN CABLE mounted on heavy trunnions to facilitate paying out and control. Two men in rear on left-hand brake do not show.

All shipments of parts of the cableways were delivered to the job from the main-line railroad over a 5-mi. heavy-duty concrete highway. Heavier loads were handled on low-slung trailers, with the 3-drum main hoists each offering the maximum unit load of 41 tons.

No special problems were involved in erecting the structural steel head and tail towers. Sectional concrete-block counterweights for all four towers were cast at one yard. These blocks weighing 4.5 tons each, were poured 6 or 7 high in stacks by using forms that could be jacked up as pouring progressed. Cleavage between the blocks was obtained by inserting a layer of tar paper at the proper heights. Two ¾-in. eyebolts were cast in each block to facilitate handling. The blocks were made of comparatively lean concrete, so some reinforcing steel was embedded in each block to keep the latter intact in case of cracking from any cause.

Motor trucks delivered the total of 360 precast blocks from the yard to the towers. Loading was done by a portable crane and unloading at the towers with a fixed unit. The latter also set the blocks in place on the towers.

Makers of the 3-in. main-track cables delivered each of the latter, weighing 22 tons, on a single reel in one piece. Each end of this cable was embedded at the factory in molten zinc poured in a specially designed ball-bearing swivel head attached to a yoke in such a manner that after erection it is a simple matter to adjust the twist in the cable and periodically turn it on its axis to distribute the wear. These two yokes also provided means of attachment to the head and tail towers.

Each cable reel was mounted at the base of the head towers on a pair of heavy timber trunnions so the cable might be unwound from it. Hand-operated friction band brakes installed on both rims of the reel had ample capacity to control the paying out of the cable as desired. This arrangement worked without a hitch, although the load was very heavy while the cable was being lowered down the steep cliff directly under the head towers.

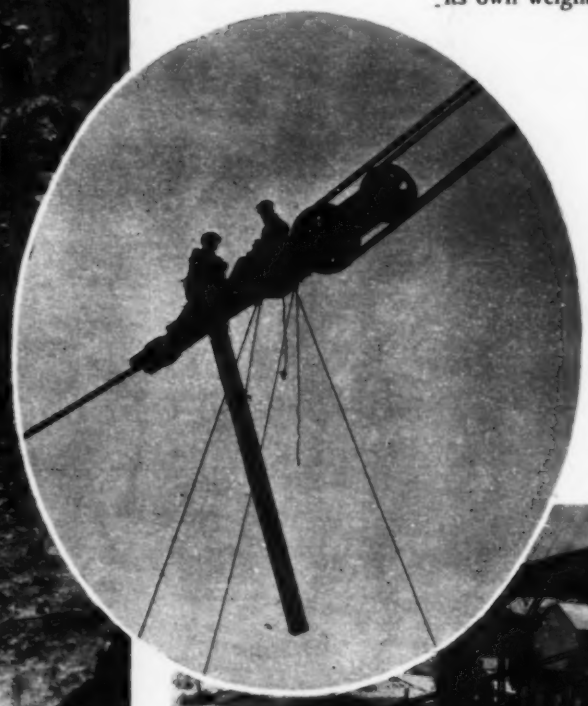
Before paying out of the main cable was started, a 1⅞-in. steel messenger line was drawn across the valley and made fast to the head and tail towers. Then, as the main cable came forward,

PAYING OUT MAIN CABLE with messenger line above at left. Smooth runway of planking on rim of cliff avoids damage to cable.

SWIVEL AND YOKE *(left)* on end of main cable landed near tail tower where connection to take-up is being made.

it was first lashed to this messenger line until bolts on a clamp carried by a grooved-wheel sheave traveling on the messenger line could be set up tight. These erection supporting sheaves were spaced 50 ft. apart.

Until the main cable reached the low point in the sag of the messenger line, its own weight carried it ahead. From this point on, a line from a hoist mounted on a tractor set up across the valley pulled the end of the cable up to near the base of the tail tower. Here connection was made between the yoke and the 10-part take-up blocks lying on the ground and reeved at the top of the tail tower. The cable then was drawn up to the desired sag by pulling on the line in the take-up. Constant tendency of the cable to unwind was overcome while the tail tower end was being hoisted by means of special clamps and by simply lashing one end of a long, heavy timber to the yoke.

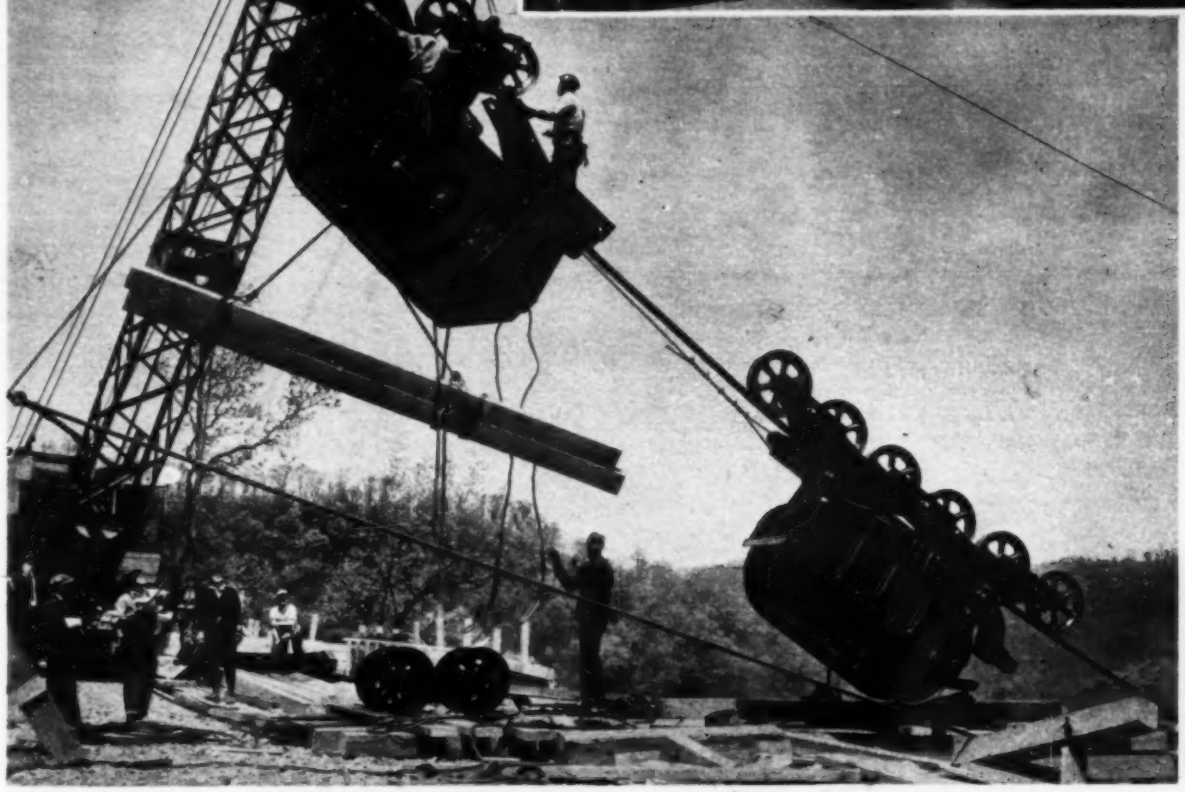


RAISING TAIL-TOWER END *(left)* of main cable by means of take-up.

As soon as the main cable had been made fast at both ends, the messenger line was slacked until it swung under the main cable. Then a man in a boatswain's chair suspended from a block traveling on the messenger line was drawn across the span to unloosen the clamps so that line could be lowered and removed.

The two-part carriage of each cable-way was delivered with each unit assembled. The three pairs of traveler wheels on each of the two carriage units were removed so a long-boom crane could hoist the frame of the unit up where it could be lashed to the main cable near the head tower. Then the pairs of wheels were lowered to place and reassembled in the frame. Finally, the two units were brought to the proper spacing on the cable and fixed in that relation.

SWIVEL AND YOKE at head tower end of main cable. Wooden trough at extreme right guided them as they were hoisted to place at top of tower.



PLACING SECOND of two units of one of the carriages on main cable.

A. E. Morgan is chairman and chief engineer of the Tennessee Valley Authority, C. A. Bock is assistant chief engineer, C. H. Locher is construction consultant, and A. J. Ackerman is construction plant engineer. Barton M. Jones is construction engineer, with Ross White, superintendent of construction, and F. C. Schlemmer and E. M. Whipple, assistant superintendents of construction.

Getting Down to

DETAILS

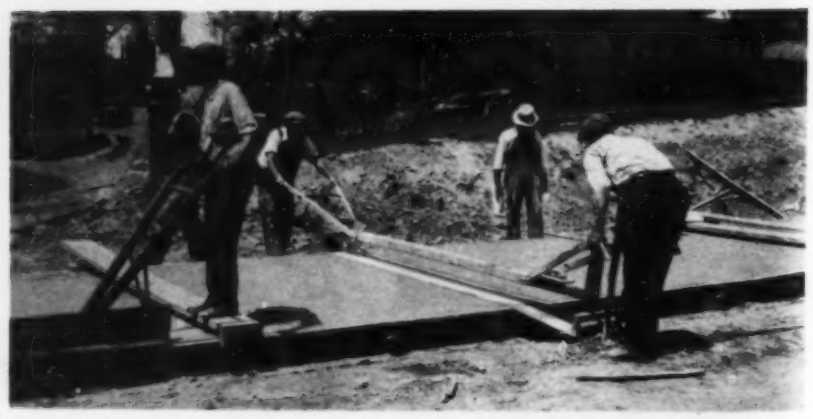
[Close-up Shots of Job Methods and Equipment]

"CLEOPATRA'S BARGE." For checking "A"-line clearance in Bernasconi tunnel which Hamilton & Gleason Co. is building as part of Colorado River aqueduct for Metropolitan Water District of Southern California, E. L. Cranford (seated on frame) has devised this junior jumbo, mounted on light tram car that can be lifted and moved aside to pass regular tunnel traffic. On front of car is swinging arm supporting revolving sleeve set on tunnel axis by light ray from reflector on adjustable rod shining through peep hole on similar rod, both rods being suspended from roof spads. Roof A-line is determined by graduated rods with shortage reading direct at tunnel axis. Wall A-line is determined by rods graduated to show horizontal offset at markers placed at 1-ft. intervals and read at plumb line from sleeve at tunnel axis.

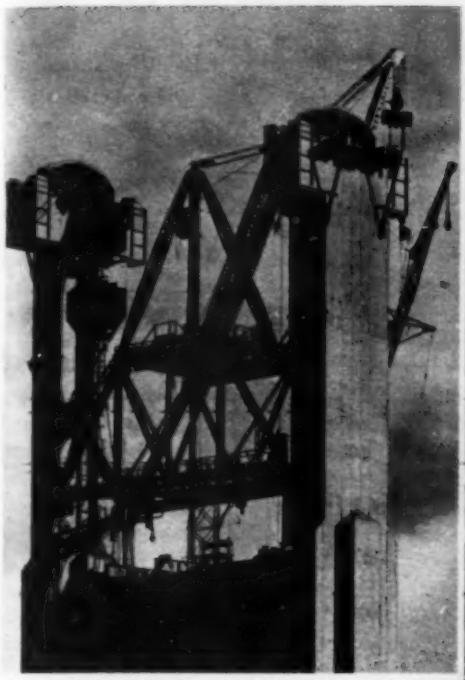
NEW POWER SUBGRADER *(below)* is used by Cameron, Joyce & Co. in building state route 104 in Illinois. R-B machine riding on forms has series of cutting blades to remove excess material which is delivered to elevating conveyor and discharged on shoulder beyond forms. Cutting blades are followed by a finishing member that leaves grade accurately crowned, smooth and compact. Bridge traveling on own wheels carries trucks over subgrader. Blades move back and forth with lateral motion, cutting in horizontal plane to depths of from 2 to 5 in. and passing over each spot five times.—*Photo from C. M. HATHAWAY, engineer of construction, Illinois Division of Highways.*

SNOW FENCE POSTS along Pennsylvania highways are driven, without deformation, by device consisting of cast-steel cylinder closed at upper end and fitted with extended slotted guides. Blow is struck by two men raising 60-lb. driver and pulling down with maximum force.—*Photo from SAMUEL ECKELS, chief engineer, Pennsylvania Department of Highways.*

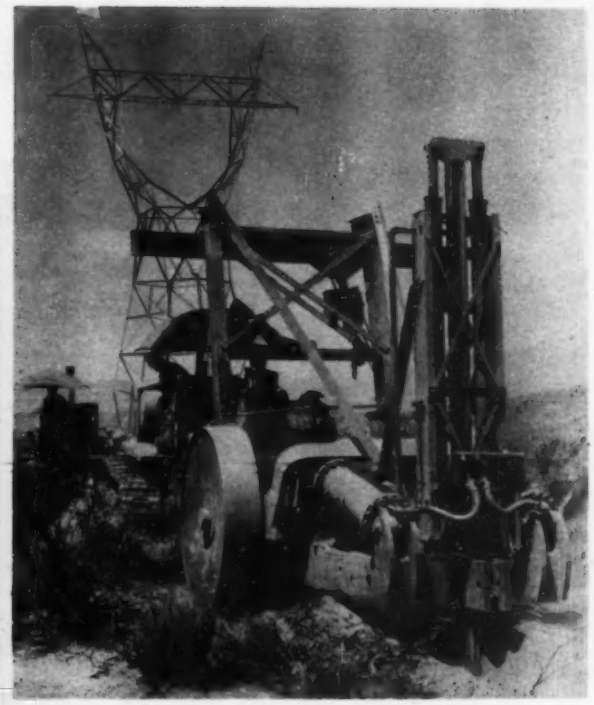
REINFORCED BRICK MASONRY is used for state highway bridge near Newcomerstown, Ohio. Structure designed by J. R. Burkey, bridge engineer, Ohio State Highway Department, consists of two 32-ft. skew spans with 24-ft. clear roadway. Abutments and piers are of reinforced brick masonry with concrete footings. Faces are laid up in common bond, using headers every sixth course. Beams are faced with common brick, with special decorative treatment employed in panels.



TRUSS MOUNTING and plow handles, used behind longitudinal float (at left) for finishing concrete paving on job of W. A. Wilson & Sons, of St. Mary's, W. Va., makes manipulation easy for two operators.



SADDLES *(above and right)* are placed to carry cables of Golden Gate bridge, San Francisco, over top of Marin tower. Pair of 160-ton saddles are 746 ft. above water level and will constitute supports for 36½-in. cables that will carry 4,200-ft. suspension span. Each saddle is mounted on 34 rollers 8 in. in diameter and weighing 1,700 lb. each, on which saddles gradually will roll forward as cables are loaded. Size of these castings may be judged from workman below center of saddle *(right)*.



FOR LAYING COUNTERPOISE WIRE underground along 270-mi. long transmission line serving Boulder Dam, specially designed plow, towed by two Caterpillar "70" tractors, is used by Los Angeles Bureau of Power & Light. Machine weighs 8 tons when loaded with reel carrying 4,000 to 5,000 ft. of wire which is laid at rate of 1½ mi. per hour.

COMBINATION BLACK-AND-WHITE traffic stripe *(below)* on center line of four-lane highway in California increases vehicular safety. Advantage is in greater color contrast, particularly at night, which reduces hazard of collision along line separating lanes in which vehicles travel at high speed in opposite directions.

FOR UNDERWATER BLASTING this special tool facilitates sinking of holes *(left)* and loading with dynamite cartridges *(right)*. Device, known as T-punch bar, has removable core. The tool is pushed into sand to necessary depth and the core is then removed to allow dynamite cartridges to be dropped into place. Dynamite is held in place with tamping stick while outside pipe is removed.

Photos, duPont

METAL RING CONNECTORS

Transmit Joint Stresses in 180-Ft. Timber Arch

BALL AND SOCKET HINGES *(left)* were used at spring line to facilitate erection.

BRIDGE SITES on the California coast highway now under construction south of the city of Monterey, Calif., are in such remote locations that hauling materials to the sites was an important factor in determining the type of structures to be built. The lightness of timber, its immunity to corrosion in salt fogs and the fact that timber bridges could be salvaged if relocation of the route became necessary after heavy slides, gave timber a considerable advantage. In a 100-mi. length of the new road fourteen timber bridges have been constructed. One of these, across Dolan Creek, required a span of 180 ft. and for this crossing it was decided to use a three-hinged timber arch put together with extensive use of metal ring connectors. This is believed to be the largest bridge in this country on which this type of timber construction has been used.

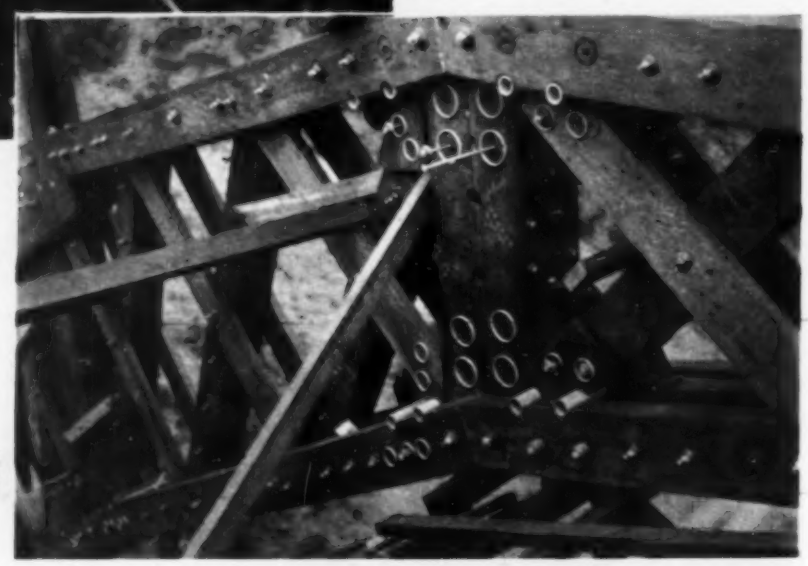
On this structure, to which the haul from the nearest railroad was about 50 mi., the use of metal ring connectors made it possible to carry all principal stresses in timber members. With the exception of four lines of longitudinal steel I-beams in the floor system and other miscellaneous metal, the entire structure consists of redwood timber. To facilitate erection a ball-and-socket type hinge was used for each arch rib at its abutment. With this arrangement the arch could be erected in any position and then swung into final location or, it could be assembled in place. The contractor decided to follow the latter plan.

Prefabrication in Framing Yard — Framing of the timbers was done in a yard established by the contractor at Monterey, the nearest point on the railroad. Here the work of cutting, tooling, boring holes and making daps in the timbers was done, the arch ribs were assembled and, finally, taken apart for shipment. In the framing yard a base line first was laid out on the ground as the central axis of the rib. At points on this axis corresponding to the rib panel points short-legged bents were constructed, all measurements being made of the size required for the finished rib. One layer of the rib chord timbers then was laid on the bents in correct position, sawed to length in place and fastened to the bents to hold it in position.

This layer, supported by and fastened to the bents, became a template for the succeeding layers. During the fram-

DOLAN CREEK CANYON *(left)* is 130 ft. deep below grade line at this 180-ft. timber-arch bridge.

COMPRESSED AIR TOOL *(left)* for boring circular grooves for metal connector rings used in timber joints.



TYPICAL CONNECTOR RING panel point *(right)* in an arch rib.

ing it was turned over once so that two right-hand and two left-hand ribs were made. When all the laminations had been cut to length the complete rib was assembled with all web members, filler blocks, corbels and verticals in place and then bored for bolting.

Two-man cross-cut saws were used for framing and as each rib was laid up, a cut was run through the butt joint of cord to insure full bearing. Corbels were shaped with an adz and finished with a joiner plane. Gussets were beveled with adz and joiner. Finally, the rib was knocked down, grooves were cut for the split ring connectors and the several parts, all carefully marked for re-assembly, were hauled to the site at Dolan Creek.

In boring holes for the 3½-in. pipe shear keys the ordinary expansion bit was not satisfactory because the screw would walk in the joint between timbers. A special bit developed in San Francisco in 1915 for use in constructing the wood frame buildings of the Panama Pacific Exposition was found satisfactory. The success of that type of bit was in the use of cutters on opposite sides of the horizontal bar. By having vertical cutters and a splitting knife on either end of the bar, the operation of the bit was balanced. This bit required that a 1-in. hole be prebored to center the cutters which are mounted on a 1-in. shank.

Hand-operated boring machines were tried out and proved satisfactory for starting holes accurately. Those employed on the job, however, were found to be effective only for about 18-in. depths and deeper holes were finished by hand brace. Accuracy of boring did not seem to be bettered by using power drill machines, although the latter would work five to eight times faster than hand boring on this operation.

A tool for cutting the ring grooves for the metal ring connectors was developed by the contractor. It consisted of two cutter blades, one groover and one router blade. Each of the two cutters was held in an eccentric tool holder, permitting of adjustment in both directions. The groover blade was set 1/32 in. deeper than the router. The grooving tool had a square shank and was operated by a hand-type compressed air drill. The air drills available, however, were too light for this work and gave considerable trouble.

Erection Methods — Falsework for supporting the ribs during assembly of the structure was built up with the 3x6-in. timbers brought to the job for later use in the laminated timber floor of the bridge. These 3x6's were double-dressed, giving them a net section of 2¾x5¾ so when two were spiked together (no bolts were used) they formed posts with a section of 5½x5¾-in. Four such posts constituted a bent at each of the panel points, in addition to which a central tower, consisting of two such bents, first was erected at the midpoint of the bridge. The falsework bents had horizontal ties at 16-ft. intervals vertically; otherwise very little lateral or sway bracing was used.

The contractor also installed an overhead cableway along the center line of the bridge which had a capacity of 5 tons. After the falsework had been completed, the cableway began the placement of rib timbers simultaneously from both abutments working toward the center. Little difficulty was experienced in the erection of the arch rib; the individual pieces went into place with ease and the crown arch pins were driven without undue adjustment.

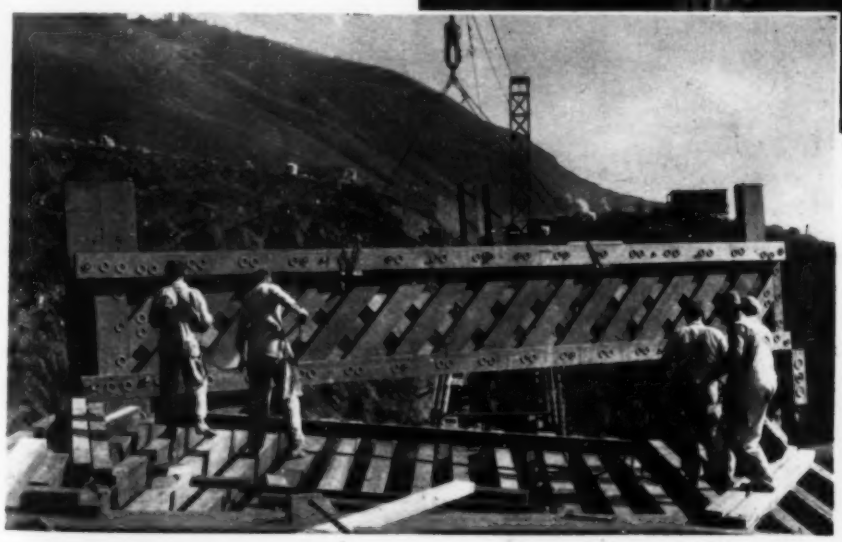
Fabrication in the Monterey yard was begun on July 23 and completed on Aug. 15, 1934. Erection at Dolan Creek was started Aug. 17 and the arch ribs proper were practically ready for proceeding with construction of the superstructure by the latter part of September.

The contract for construction was carried out by Rocca & Caletti, of San Rafael, Calif. The contract price was $68,000.

C. H. Purcell is California state highway engineer, F. W. Panhorst is acting bridge engineer, H. D. Stover is designing engineer, Department of Bridges, and H. L. McCready is resident engineer at the bridge.

H. L. McCREADY *(right)*, California Division of Highways, resident engineer on Dolan Creek Bridge.

FLOORING consists of 3x6-in. timbers laid on edge.



PLACING 38-ft. lattice timber girder span *(left)* on Dolan Creek bridge approach.

LOOKING ALONG LINE *(right)* of 5-ton cableway used to place rib-timbers.

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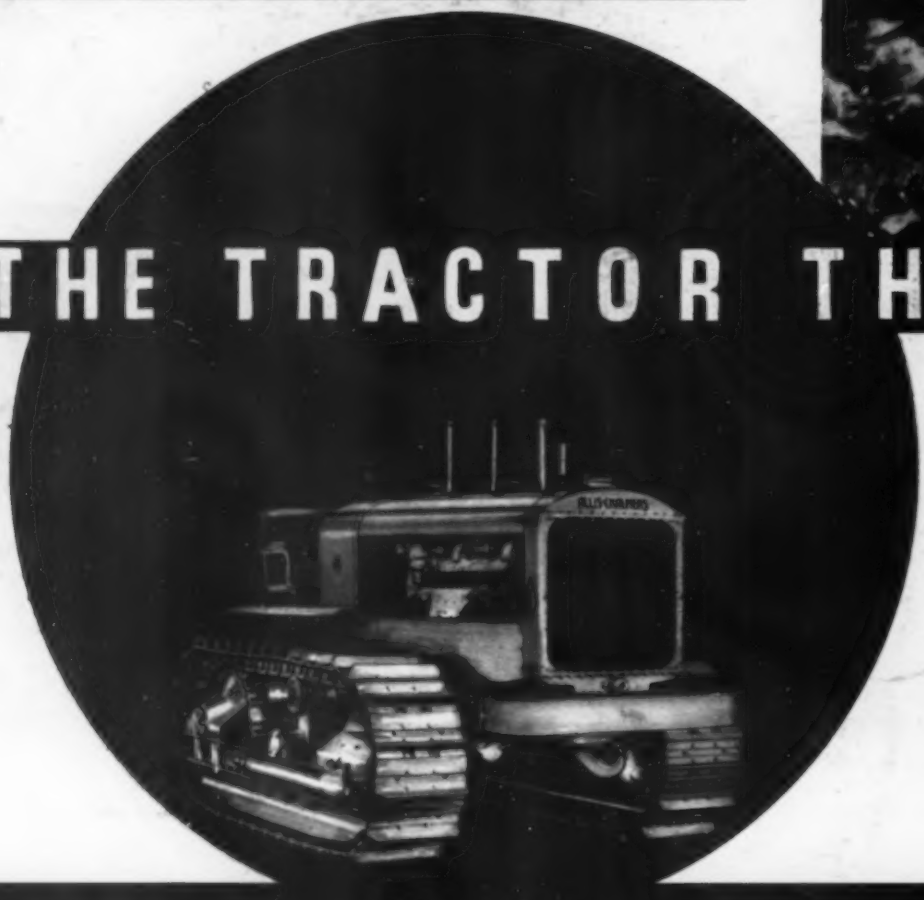

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NEW BUILDING to house contagious ward of Gallinger Municipal Hospital, Washington, D. C., has brick masonry exterior load-bearing walls and interior steel skeleton supporting cellular steel floors. One wing of main building appears in right foreground and administration building in left background, with portion of inclosed corridor connecting two units in center, at right.

CELLULAR STEEL FLOOR

Provides Electrical Flexibility

A PREFABRICATED cellular steel-plate floor erected and welded in place on 68,000 sq. ft. of floor area in a new building for the contagious ward of the Gallinger Hospital, Washington, D. C., provides a degree of electrical flexibility which makes the building adaptable to any kind of electric power utilization during the structure's expected life. In addition to assuring electrical flexibility, the cellular steel floor, because of its combination of light weight with great strength, reduced the dead load of the floor and permitted a reduction of about 10 per cent in the weight of the steel interior frame of the hospital building. Furnished and erected by the H. H. Robertson Co., of Pittsburgh, under contract with the D. M. W. Engineering Corp., of Brooklyn, general contractor, the floor was placed rapidly and was immediately available as a working platform for the following trades on the building, greatly facilitating their operations. This feature aided the general contractor in overcoming, to a large extent, a delay caused by a general strike, lasting six weeks, of all carpenters in the District of Columbia.

Hospital Building — Originally designed for concrete joist floors carried by exterior brick bearing walls and an interior steel skeleton, the design of the hospital building later was modified by the office of the architect of the District of Columbia to permit the taking of alternate bids on cellular steel floor construction, which offered lighter weight and much greater electrical flexibility. The modification consisted principally of a redesign of the structural steel interior framework to take advantage of a reduced dead load.

In plan, the main portion of the building consists of a long central section 136 ft. by 44 ft. in dimensions, with two divergent wings at each end. These wings are 82 ft. long by 38 ft. wide. In front of the main structure is an administration building, measuring 70 ft. 8 in. by 44 ft. in plan, connected to the main building by a corridor 24 ft. long and 10½ ft. wide. The complete building has a floor area of 68,000 sq.ft.

Except for a small four-story section immediately behind the administration unit, the main building is designed to be three stories high. Under the present contract, only the cellular steel system was laid on the third floor, supporting a temporary mopped wood roof. The small four-story section of this building was erected to its full height, of which the fourth story is a penthouse inclosing elevator machinery and storerooms. The administration unit was erected to its designed height of two stories and was given a permanent roof. Unfinished portions of the main building will be carried to completion when need for a third story develops.

Cellular Steel Floor—Substitution of the cellular steel-plate floor on the hospital building reduced the designed dead load by more than 40 per cent—from 80 lb. to 45 lb. per square foot. The steel floor was made up of standard K-type Keystone units. An accompanying illustration reproduces a cross-section of one floor unit. The design originally was developed as the most economical type of steel-plate floor amenable to practical low-cost manufacturing.

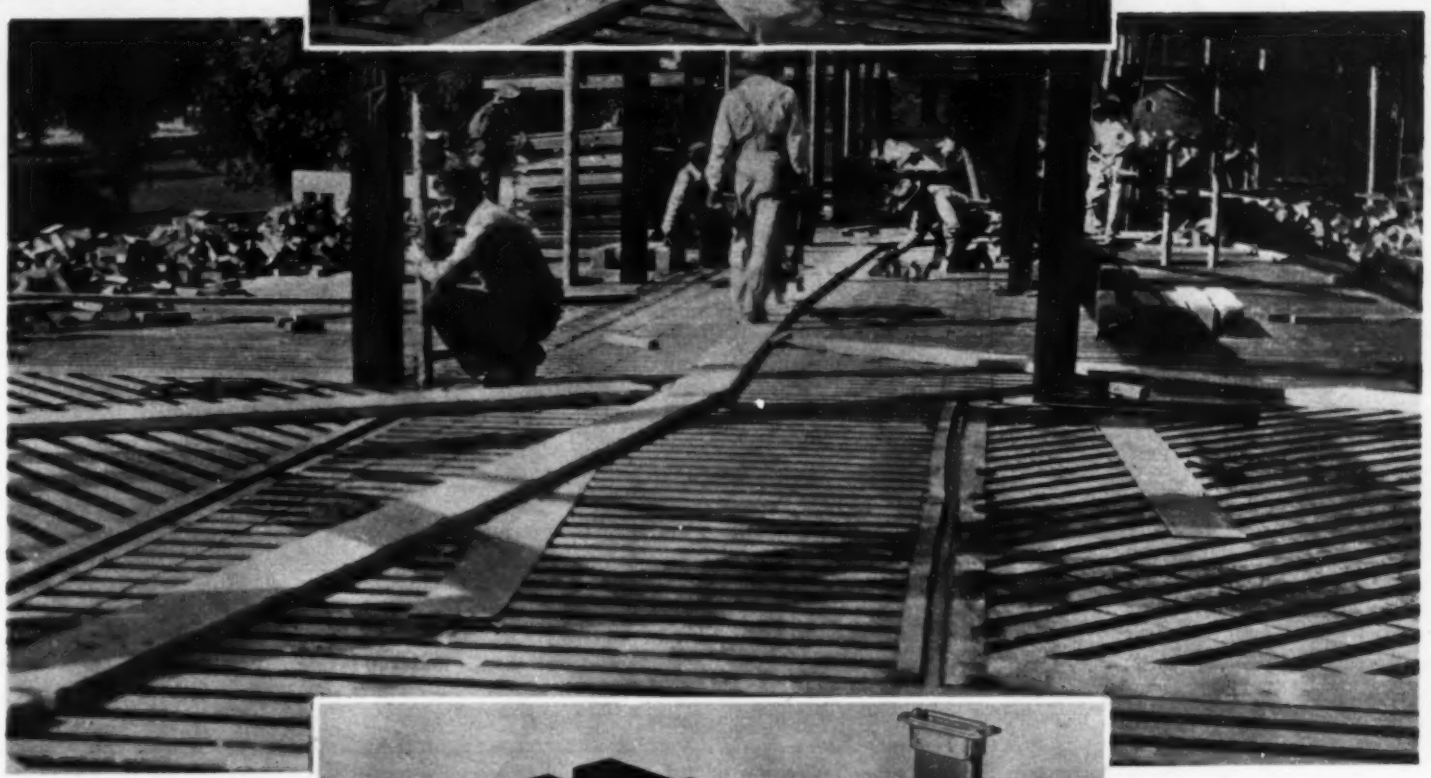
Standard sections of the steel floor laid on the Gallinger Hospital addition were 2 ft. wide. Units of this floor system, however, can be prefabricated in the shop to any length required to fit plan dimensions. The floor unit consists of a top and a bottom plate, each formed separately in a rolling mill. Before forming in the rolling mill, the plates for the floor units are sheared to exact length. After rolling, the plates are assembled in position as a unit and are put through a continuous pressure-welding machine especially built for this operation. The electrodes are rollers in continuous contact with the plates, automatically spot-welding the two together on the indicated double line between the cellular beams.

Following the welding operation the completed cellular unit is given a protective dip coat of asphalt, which is baked on. This coating completely covers both the insides and outsides of the cells. Each unit is marked at the shop

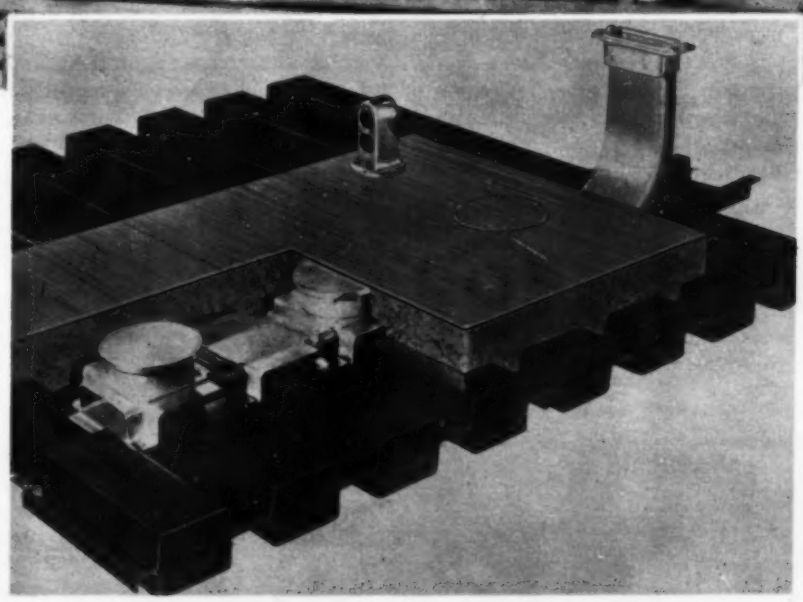
ELECTRICIAN COMPLETES INSTALLATION of entire electrical system, including wall outlets to be bricked in by masonry of exterior walls, 4 days after erectors start placing steel floor and 1 day after they finish aligning and welding cellular units.

for its position in the completed floor system of the building.

In order to use the cells as raceways it was necessary that they be kept watertight. All openings in the top surface were sealed with cover plates screwed down and cemented in place with an asphalt cement. In the interval preceding installation of the crossover ducts the duct openings in the top of the floor were covered temporarily with cover plates to prevent construction dust and broken chips of brick and terra cotta from falling into the cells. The crossover ducts themselves were set with screws and sealed with an asphalt cement just before the floor finish was applied.



FLASHING OF Z-PLATES ***(above)*** **protects open ends of steel cellular units where floor sections meet at an angle on structural beam. This flashing, fastened and sealed in place, keeps concrete floor fill out of cells.**



MODEL OF CELLULAR FLOOR (of type somewhat different from that used in Gallinger hospital addition) illustrates method of installing crossover duct having access units set flush with surface. Each cell equipped with access unit is available for electrical outlets (one of which is shown) throughout its entire length.

Design of Hospital Floor — When considering the cellular steel floor as an alternate to the original floor design the architect of the District of Columbia determined to utilize the full potentialities of the cellular construction for electrical flexibility, equipping every cell with necessary access fittings for future installation of wiring. Accordingly, all the cells were connected into appropriate crossover ducts, laid in the corridors, for high-tension, low-tension, and telephone service, with each group of three cells serving the three systems. In other words, each system is connected into every third cell. Thus, in the future, any type of service can be brought into any desired spot in the entire floor area of the building, without remodeling and without expensive or bothersome work.

These wiring facilities greatly increased the electrical flexibility of the floor over the alternate design and required an access unit in one of the three crossover ducts at every cell. In spite of the added cost of installing a duct system providing maximum flexibility, the cellular steel floor still offered an appreciable saving over the alternate construction, which provided no underfloor duct system whatever.

Erection — Cellular floor sections erected on the Gallinger Hospital addition were made of 16-gage steel plate and weighed about 21 lb. per linear foot of 2-ft. width. In length the sections ranged up to a maximum of 17½ ft., weighing about 350 lb. The sections were raised to the second floor by a hand winch and to the third floor by a power hoist. The erection crew unloaded the sections from trucks and raised them to the proper floor before distributing the units in accordance with the shop markings. Two men handled each section, skidding it over steel floor previously laid to its proper location, where they placed it on the steel-

EVEN BEFORE WELDING ***(left)*** **of steel floor is completed, bricklayers start building section of exterior wall in which electrical outlets already have been placed. Floor withstands severe usage in storing materials without damage.**

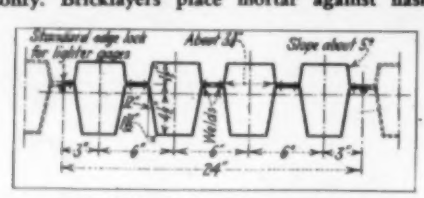
work approximately in final position. Actual weight of steel involved in the 68,000 sq.ft. of floor was about 360 tons.

After the floor steel for an entire structural unit, such as a wing, had been laid, the sections were brought to true position in relation to the crossover ducts in the corridors and the cells were tack-welded to the steel beams or to bearing angles. To assure a uniform bearing for the cellular steel floor sections in the brick exterior walls, steel seat angles were set in mortar at the proper elevation. The sections were tack-welded to the supporting steel at every second cell. Along the longitudinal edge-lock joints between adjacent sections, the units were tacked together with 1-in. welds about 3 ft. on centers to form a complete unit system. Tack welds on successive joints were staggered. The field weld spots and any abrasions in the top protective coating were touched up with a special asphalt paint.

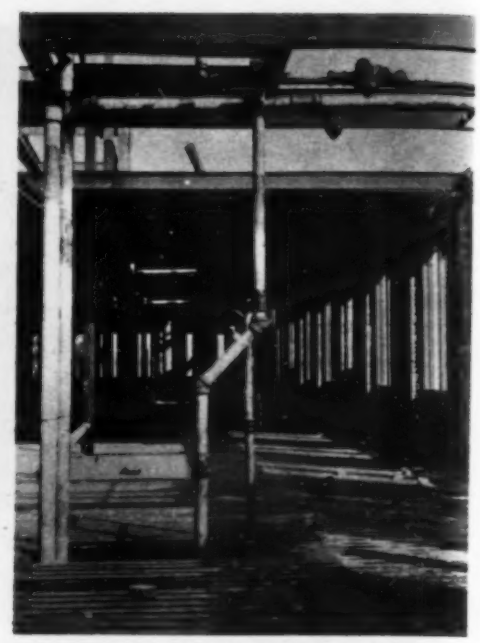
Because of the delay caused by the carpenters' general strike and the resultant dislocation of operating schedules, the possibility of rapid floor construction could not be demonstrated until the second floor was reached. When a

WELDING OPERATOR tack-welds steel cells to supporting structural beam where beam is exposed. Tight-fitting wood blocks, cut to shape of top grooves in cellular floor, hold abutting sections in line until welded.

METAL FLASHING, to be seen beyond three electrical wall outlets, covers open ends of steel cells in brick masonry. Bricklayers place mortar against flashing.



SECTION of K-type steel floor erected on new Gallinger Hospital.



ABSENCE OF SCAFFOLDING, shoring or other encumbrance under floor being erected facilitates work of plumbers, steamfitters, plasterers and additional following trades.

unit comprising two wings and a portion of the central building, having an area of about 10,000 sq. ft., was released for floor, that area was erected, aligned and welded in three days and turned over to other trades for their work. When working at full capacity, the erecting force consisted of a foreman, six men handling sections, and a welder with a helper and an engineer. Two burners cut pipe holes and other openings in the steel floor for their respective trades after the floor was in final position.

Special Details—A flashing of Robertson protected metal sealed the ends of the cells in the brick masonry exterior walls. A backing of mortar was placed against this metal by the brick masons. Above the steel floor beams, the tops of the steel cells at their ends had to be left open to permit welding of the cellular floor to the steel frame. These openings were closed by steel plate covers cemented with asphaltic cement and fastened down with metal screws. Tight-fitting wood blocks cut to the shape of the groove in the cellular floor were used to hold adjacent sections in alignment until the welders could tack them securely in place. These pieces were used for various purposes by the other trades. The sash setter, for example, utilized them as foot blocks in bracing window sash until the surrounding wall could be built.

A circular hole for a laundry chute about 30 in. in diameter had to be cut through the steel floors. This hole intersected two cellular sections on each floor. In the longitudinal direction of the cells, the edges of the opening were reinforced by 6-in. channels placed inside the cells, which were exactly 6 in. in clear inside height. The channels extended across the span between two floor beams. In the transverse direction steel angle lintels were welded to the top of the floor to support the walls of a rectangular masonry partition around the chute. These lintels rested at their ends on the cells inclosing the steel channels.

Effect on Other Trades—As the steel floor could be put to use by the bricklayers even before the welding was completed, it expedited operations of the mason subcontractor. The floor was utilized as a storage and working platform and as a base for the erection of interior scaffolding, all brick walls and face stonework being erected from the inside.

Holes were provided in the sides of the cells for hangers to support the cross-furred plaster and wire-lath ceiling and to carry the plumbing pipes. Because of the ease of cutting openings in the steel floor, it was unnecessary for other trades to put a man on the job until their erection crews were ready to go to work.

Floor Finish—Specifications called for a lightweight concrete fill on top of the cellular steel floor, but this specification was amended by the architect to permit the use of a dry mixture of ordinary concrete. The finished floor is 2⅜ in. above the top of the cellular steel floor and 8½ in. above the top of the structural steel. Corridors are surfaced with rubber tile on concrete and have a terrazzo cove base molding. Except for the service rooms, which are finished with plain concrete, the rooms have terrazzo floors applied directly over the top of the fill on the steel deck. The floors of consultation rooms in the administration unit are covered with ceramic tile laid on concrete.

Erection of the steel floor was carried out by the forces of the H. H. Robertson Co., all work being directed by their representative, R. W. Gastmeyer, who also supervised the cutting of holes for other trades, thus insuring no injury to the floor as a structural unit. The building was designed in the office of Nathan C. Wyeth, municipal architect, District of Columbia, and construction was supervised by inspectors attached to that office.

TWO STAGES in erection of cellular steel floor. With brick wall built to proper elevation and riveting of structural steel complete *(left)*, floor is ready for erection of cellular sections. Steel-angle sills are set to final level in mortar on brick masonry. After 1½ days *(right)* cellular steel floor is in place and needs only aligning and welding before being turned over to following trades, 3 days after start of erection.

Quality Labor for Construction

By **D. V. PURINGTON**

Resident Engineer, Texas State Highway Department

THE problem of procuring proper and adequate labor for construction projects has never been a real serious consideration for the majority of contractors. They have devoted the most of their attention to the purchase and selection of materials and equipment rather than to the selection of labor, probably because the labor cost of construction has always been a variable item and presumably a minor one.

In the past, the contractor was able to procure superintendents and foremen with followings of skilled hands, who trekked the country in cars, trucks and trailers and called it home wherever they could hang their hats. Among these were experienced mechanics of all kinds, who could, when the occassion demanded, step into a foreman's shoes and carry on. They acted as key men and leaders and enabled the contractors to make fair use of the local labor needed to fill out his crews to full strength.

But when the construction industry was marshalled into the fight against depression and the regulations regarding the use of local labor were installed, these key men of construction were practically eliminated from the contractors' organizations because they had no permanent homes. As a result, the absence of these key men or sub-foremen has raised the labor cost to a more important place on the horizon and the responsibility of the superintendents and foremen has been materially increased.

Starting a construction job today, particularly in an isolated rural community, is like opening the parcels at a blind package auction, where the bidder buys without knowledge of the parcel contents. The contractor gets his labor from the local labor authority on the same basis and since there are no more key men to depend on as leaders for these inexperienced local men, the necessity for more careful and skillful selection of personnel and the need of more definite direction has put much greater responsibility upon the men in charge of the contractors' operations.

This necessity for more skilled and detailed direction of labor has not been as thoroughly recognized by the contractors as it should be and the resulting burden on the supervisory forces has been a serious factor in the increasing labor cost on some of the present work.

The natural remedy for this condition under the existing system is to increase the supervisory forces and to provide more foremen with smaller gangs, possibly promoting some of these experienced followers to positions of permanent foremen to supply the demand. But, this means increasing the overhead cost of construction, an act which has always been religiously avoided by the majority of contractors regardless of the possibility that the increased quality of supervision might result in an increase in production which would actually reduce the overhead charges per unit even though the gross overhead cost of the job is increased.

The fact that these skilled men who followed from job to job are now always fully qualified as foremen, is another deterrent factor. Most men of this character are not educated men with the proper technical training to carry them into positions of secure trust in construction work. They may qualify as satisfactory subordinate leaders but only a few will have the initiative to take up technical studies and develop themselves as construction executives.

Due to the fact that the majority of subordinate positions are generally filled in the above manner from the ranks of the followers, there is little incentive for the technically trained man to start at the bottom in the construction field and attempt to work his way up. This is particularly true under the present 30-hr. week and minimum wage scale which does not offer nearly so much as the engineering fields of the various governmental agencies which are not so restricted.

Local Labor Supply

Since the contractor is generally engaged in the construction of a structure of more or less permanence and of public utility and since the very nature of his business, even without the restrictions of the depression struggle, is periodical and not continuous, it would seem only fair that he be allowed to take his pick of the best of the available labor supply with the least possible delay. Even in normal conditions, the local supply of labor for construction work is not of the best, due to the arrangement of our society which naturally absorbs the better grade of men into more or less permanent positions or jobs in the community and leaves the lower grades and youths just out of school to take the temporary work which public construction provides.

It appears that a classification of the present supply of labor could be made with the existing labor agencies if proper cooperation could be obtained between the National Reemployment Service and the contractors. The general purpose of the National Reemployment Service is to aid in the improvement of business by giving service to the unemployed and to the employers in filling jobs that become available as public works are let. Therefore, if a system of classification similar to the systems used in some of the modern industrial plants could be used by the contractors and the National Reemployment Service combined, the construction industry could be materially benefited and the cost of selecting, trying and fitting local labor generally reduced.

Under the existing system, the National Reemployement Service is primarily concerned with putting the men to work in the order in which they apply and when an applicant is reported as employed his card is placed in the inactive files until such time as he again reports for re-registration. His card is then placed in the active file again, the only change being his most recent date of employment. There is no guaranty of the qualifications of the man other than such personal knowledge as the service manager may have by reason of local acquaintance and the experience record as shown on his card. The new employer has the privilege of writing or calling some of the former employers listed, but it is a rare case in which a contractor or contractor's foreman can and will take the time to run down references of either skilled or common labor. Under ordinary circumstances, when there are skilled gang leaders already on the job, such a precaution is entirely unnecessary, but where the skilled gang leaders are absent and there is valuable equipment to be used there should be some precautions taken or some skilled personnel selection used.

In most communities, there is a fairly constant labor turnover and the men are continually coming and going in the industrial and agricultural activities of the area. There is a natural trying and fitting of men to jobs, both on the part of the employers and on the part of the men themselves and it appears that if this passage of men from job to job could be recorded and assisted by some agency such as the National Reemployment Service with the addition of a confidential report on the man's performance from each employer, the general standard of all classes of work could be improved.

Since the Department of Labor is endeavoring to supply definite information regarding the labor conditions of the country, it would appear that definite records of the employment of the men, particularly a record of the length of their employment would be advisable and this could be obtained, with the cooperation of the employers, by using a post-card form covering the termination of employment and giving reasons. This card could also be used for reporting the qualifications of the men by having the positive and negative characteristics, similar to those used on the personnel cards of some of the industrial plants, printed in columns on one side of the card. These would require only a few minutes of the contractor's time for checking and by establishing a scale based on the number of positive and negative characteristics checked, the community office would soon have a graded list of the men available for work.

The Qualification System

By maintaining this system consistently in a government agency, where the possibilities of personal prejudice or special favoritism such as might be shown in a privately operated system which depends on the collection of fees for its existence, the composite opinions of the various employers would soon provide definite information as to the general fitness of the men for various kinds of work. By always supplying the men from the top of the list first, an incentive would be given these men to put out their best efforts in order to be rated at the top of the list and thus be first in line for employment on the next job open.

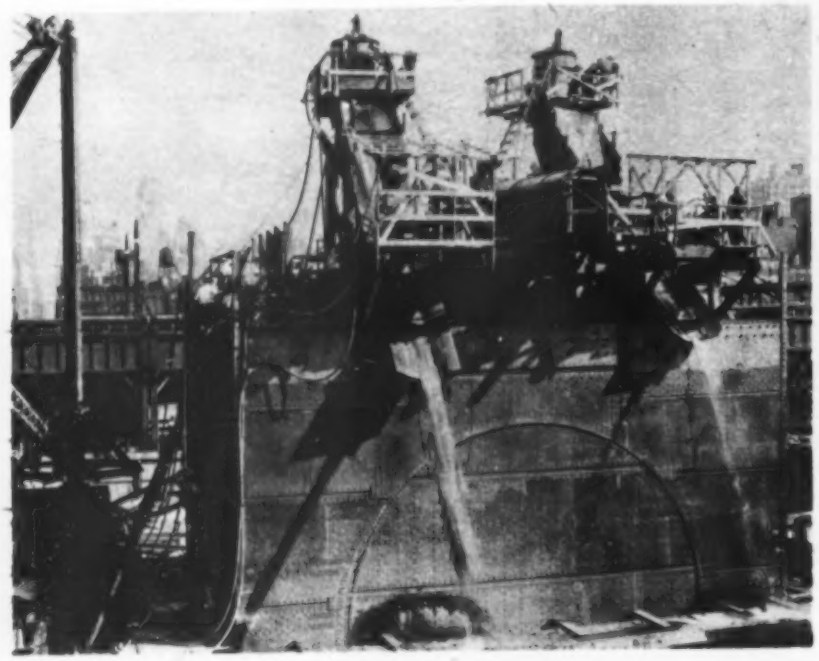
The elimination, thus affected, of the totally unfit, irresponsible and inherently lazy individuals would materially reduce the labor costs of public construction and would also tend to reduce accidents to men on the work caused by carelessness and improper selection. It would provide better opportunities for the men who are willing to work and are able to do it and would help to procure a better quality of workmanship on our public works.

For the grades higher than common labor, the personnel cards could be enlarged to contain more definite information regarding their skill and knowledge.

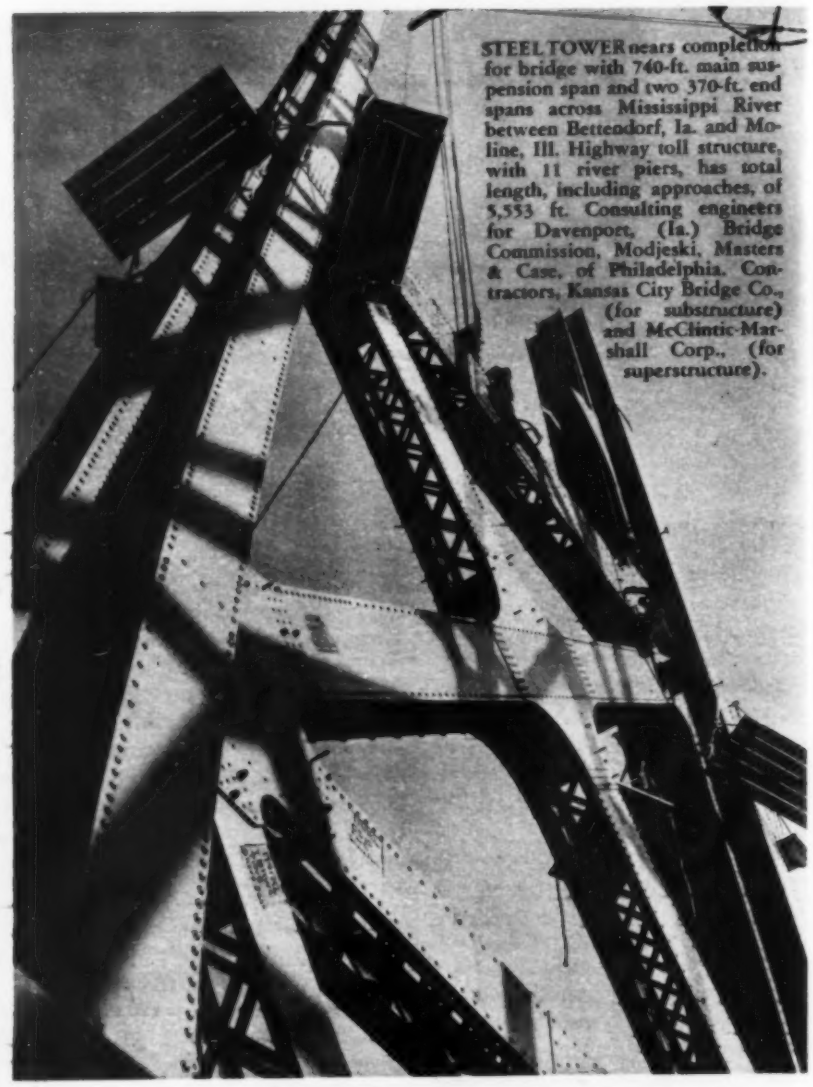
Since the problem of the unemployed is considered one of the most important we have, it would seem advisable that the problem should be handled in a definite manner which would supply true information regarding the status of these unemployed as to whether or not they are actually in need of work; whether they have some means of support and are simply looking for something to do; whether they are unemployed and wish to remain that way, or whether they are not capable of being satisfactorily employed at any kind of work.

Progress on PWA Projects

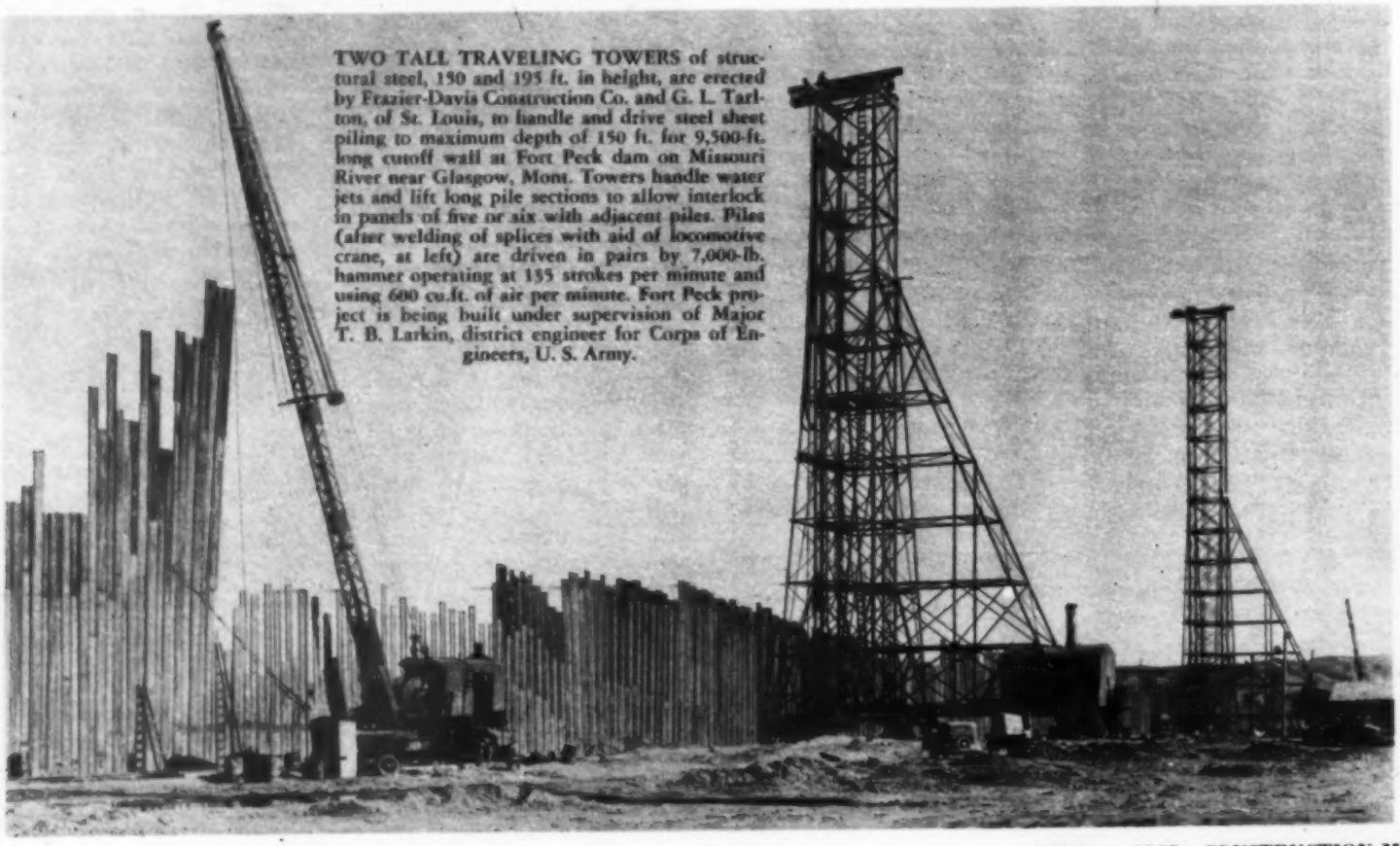
Photos from
Federal Emergency Administration of Public Works



STEEL CAISSON *(left)* **is being sunk by Mason & Hanger Co., Inc., for New York ventilation shaft of Mid-Town Hudson tunnel. First of twin shield-driven bores is 6,000 ft. long and 31 ft. in outside diameter to provide subaqueous vehicular route with 21-ft. 6 in. roadway between New York and New Jersey. Work under compressed air is proceeding from both sides of the river under PWA allotment of $37,500,000 to Port of New York Authority.**

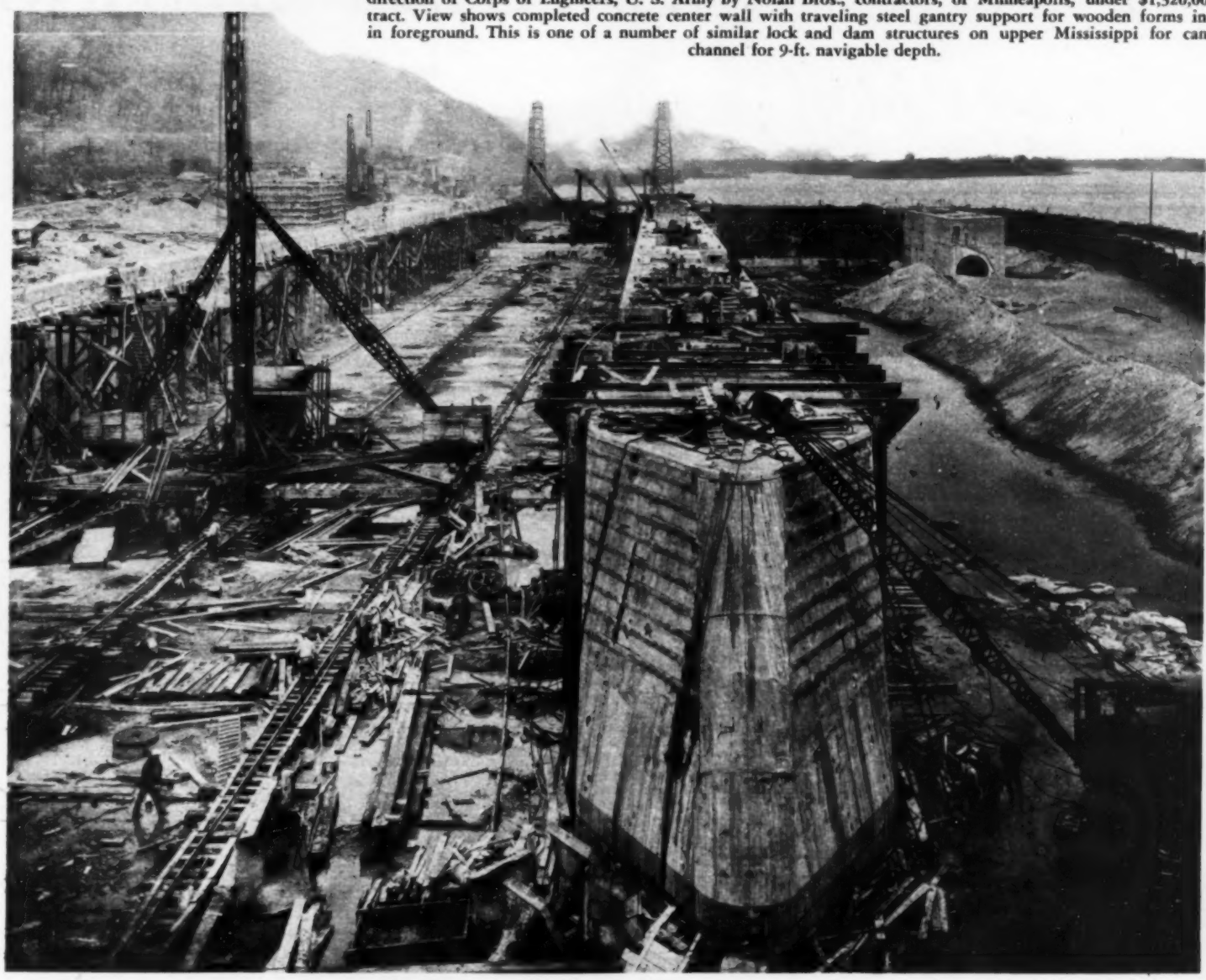


STEEL TOWER nears completion for bridge with 740-ft. main suspension span and two 370-ft. end spans across Mississippi River between Bettendorf, Ia. and Moline, Ill. Highway toll structure, with 11 river piers, has total length, including approaches, of 5,553 ft. Consulting engineers for Davenport, (Ia.) Bridge Commission, Modjeski, Masters & Case, of Philadelphia. Contractors, Kansas City Bridge Co., (for substructure) and McClintic-Marshall Corp., (for superstructure).

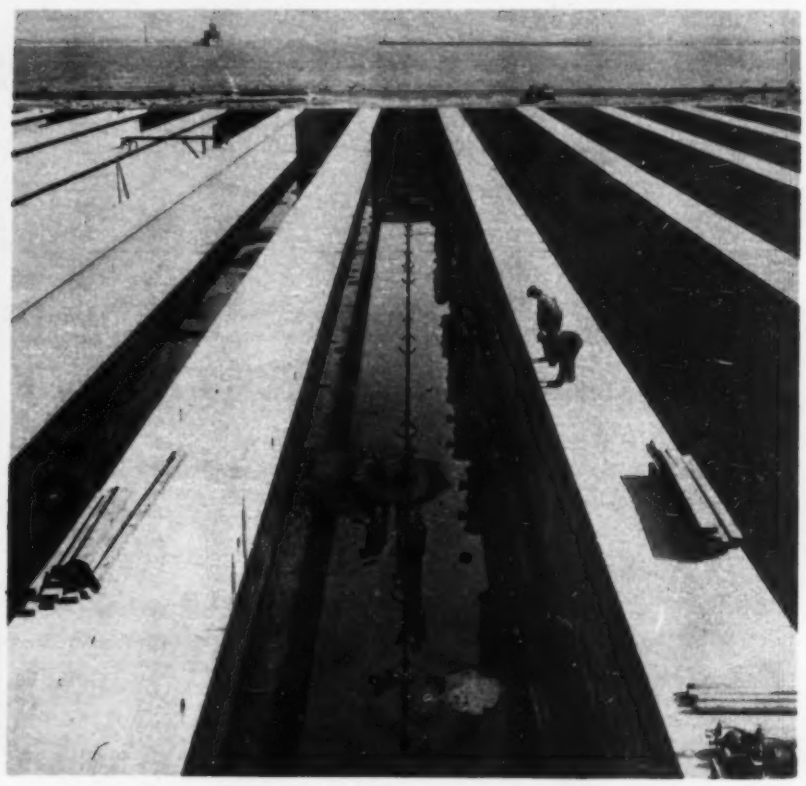


TWO TALL TRAVELING TOWERS of structural steel, 150 and 195 ft. in height, are erected by Frazier-Davis Construction Co. and G. L. Tarlton, of St. Louis, to handle and drive steel sheet piling to maximum depth of 150 ft. for 9,500-ft. long cutoff wall at Fort Peck dam on Missouri River near Glasgow, Mont. Towers handle water jets and lift long pile sections to allow interlock in panels of five or six with adjacent piles. Piles (after welding of splices with aid of locomotive crane, at left) are driven in pairs by 7,000-lb. hammer operating at 135 strokes per minute and using 600 cu.ft. of air per minute. Fort Peck project is being built under supervision of Major T. B. Larkin, district engineer for Corps of Engineers, U. S. Army.

MISSISSIPPI RIVER LOCK NO. 7 at Dresbach, Minn., is being constructed within steel sheetpile cofferdam under direction of Corps of Engineers, U. S. Army by Nolan Bros., contractors, of Minneapolis, under $1,320,000 contract. View shows completed concrete center wall with traveling steel gantry support for wooden forms in place, in foreground. This is one of a number of similar lock and dam structures on upper Mississippi for canalizing channel for 9-ft. navigable depth.



ARC WELDING is the method employed in fabricating heavy cylindrical steel reinforcement units for concrete pipe on Hetch Hetchy water supply line for San Francisco, Calif.



SEWAGE SEDIMENTATION AND AERATION TANKS form main feature of extensions to Milwaukee's sewage treatment plant built under $1,850,000 PWA allotment. Work involved construction of cofferdam in Lake Michigan east of existing plant.

RIGGERS HANDLE HEAVY CASTINGS

With Aid of

JACKS AND TACKLE

UNLOADING mainly with hand tools parts of a 42-in. gyratory crusher was done cheaply and quickly by a rigger crew of the Tennessee Valley Authority forces building Norris Dam. These crusher parts were the heaviest immobile construction units that had to be handled at the rail head, 5 mi. from Norris Dam. The material-handling crane which had been installed at this point was too small to make direct lifts of the few overweight crusher parts.

The base frame, weighing more than 27 tons, was shipped upright anchored to 12x12-in. timbers fastened to the floor of a special railroad car. In unloading, it was first raised with four 25-ton jacks high enough so the timbers could be removed and replaced by hardwood skids bolted to the base of the casting.

JACKING UP 27-ton base casting to replace shipping timbers with hardwood skidding blocks.

30-TON TOP-SHELL CASTING tipped from special well car into pile of sand. Bags of sand on edge of car distributed load on lip of casting as latter tipped.

UNREEVING BLOCK AND TACKLE, anchored to deadman in trench in foreground, by which 30-ton casting was tipped from car to sand pile.

Cribbing was next built up alongside the car and the casting skidded over on it, and then to a 40-ton truck trailer for delivery to the job over a heavy duty concrete road TVA built in lieu of a railroad. At the site of the crusher the base casting was skidded into position and lowered exactly to place by jacks. The unloading from the car took eight men about 5 hr.

It was necessary to ship the top shell from the factory with its axis horizontal in a special well car, because its diameter is 14 ft. 5 in. At the unloading point the top shell casting, weighing 30 tons, had to be turned to a vertical axis so it could be hauled safely on the 40-ton trailer. This was done by pulling the casting from the well car into a pile of sand, tipping it a quarter turn as it moved.

First the forward edge of the casting was jacked up so bags of sand could be placed under it to give an even bearing for the frames. Meanwhile a deadman was sunk as an anchorage for a block and tackle, with the hoisting line handled by a locomotive crane. With a line from the block to the top of the casting the crane applied the pull necessary to tip the shell into the pile of sand.

With the shell now resting bottom up, it had to be turned over again. This was also done with the block and tackle and crane. By hand shoveling sand at the right point the movement of the casting was facilitated. The unloading took six men one hour.

To load the 30-ton casting on the truck trailer jacks raised the casting so skids could be bolted to its base. Then the casting was skidded on to the trailer by means of the block and tackle, using the crane for power. At the delivery point the casting was skidded from the trailer to cribbing and thence to its final position.

Handling of the compact 22-ton mandrel of the crusher was comparatively simple. Shipped on a flat car, upon its arrival it was placed in a cradle of skid timbers on which it was shifted directly from the car to the trailer. At the job the mandrel was skidded under an A-frame derrick set permanently over the crusher to remove plugs.

A. J. Ackerman, construction plant engineer for Tennessee Valley Authority, furnished the information on which the foregoing notes were based.

Present and Accounted For —

A Page of Personalities

LEADS STATE HIGHWAY OFFICIALS. Capt. Arthur W. Brandt, for 10½ years commissioner of highways of State of New York, is president of American Association of State Highway Officials by virtue of recent election at association's twentieth annual meeting in Santa Fe, N. Mex. Commissioner Brandt has served on Board of Directors of association and on number of important committees.

DIRECTS WORK ON ALL-AMERICAN CANAL. R. B. WILLIAMS succeeds Ray Priest, who died several months ago, as construction engineer of canal project in California for U. S. Bureau of Reclamation. During more than 20 years with Bureau of Reclamation, Mr. Williams has served on Kittitas division of Yakima project, on Boulder Dam, and on other important work.

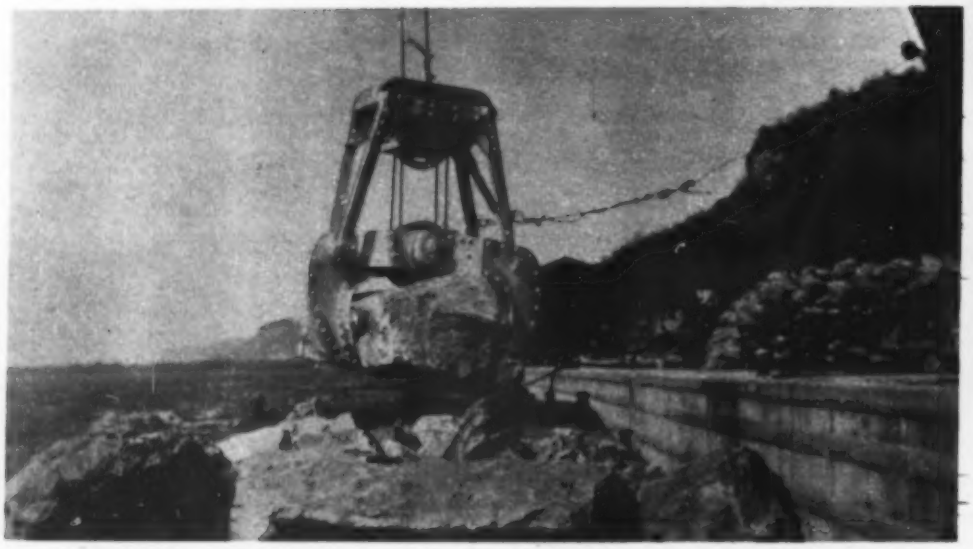
HEADS CIVIL ENGINEERS' Society. Arthur Smith Tuttle, New York state engineer for Federal Emergency Administration of Public Works, is new president of American Society of Civil Engineers. From 1902 to 1933 Mr. Tuttle served Board of Estimate and Apportionment of New York City as assistant engineer, deputy chief engineer, chief engineer and consulting engineer. In the Am. Soc. C. E., he has acted as director, treasurer, and vice-president, as well as president of the Metropolitan (New York) section.

CHAIRMAN OF HOUSING COUNCIL. James D. Dusenberry, formerly president of United Fireproof Construction Co. and now director of construction and real estate division of Federal Housing Administration, has been appointed chairman of Housing Advisory Council by Administrator James A. Moffett.

ROAD BUILDERS' CHIEF EXECUTIVE. William P. McDonald, president of William P. McDonald Construction Co., of Flushing, N. Y., is new president of American Road Builders' Association, elected at its thirty-second annual convention in Washington, D. C., last month. Mr. McDonald has been active in organizing new Highway Contractors' Division of A.R.B.A.

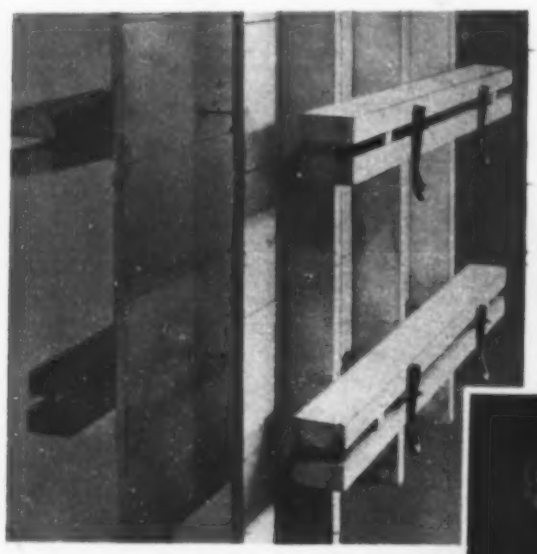
PROMOTES SAFETY IN CONSTRUCTION. E. N. Goldstine, former building construction superintendent employed since 1932 as safety engineer with State Compensation Insurance Fund of California, has been elected general chairman of Construction Section of National Safety Council.

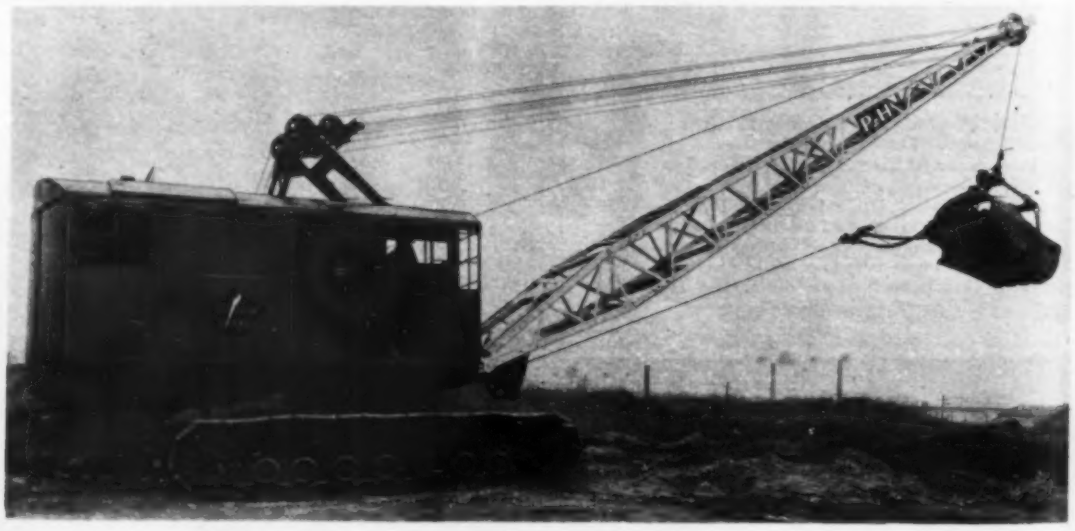
NEW EQUIPMENT ON THE JOB



THREE-TINE ROCK GRAPPLE designed for handling individual rocks and boulders develops working capacity of approximately 2 net tons for each 1,000 lb. of grapple weight. Three-point contact insures positive grip on load, preventing rock from turning and falling out. Wide spacing of two tines on one side gives grapple sufficient stability to eliminate difficulty in spotting it on rock. Proper spread of head pins obviates need of counterweights at center of grapple to assure prompt opening, thus keeping dead load at minimum. —Blaw-Knox Co., 2001 Farmers Bank Bldg., Pittsburgh, Pa.

SWIVEL HEAD CUTTER on standard bolt clipper causes cutting head to swivel to any angle on either side of handles and makes tool work equally well up or down, right or left, behind or before, in or out. Device consists of special section joined by ball and socket joint, with shoe for holding cutterhead and positioning spring to hold head in desired position. Shoe will hold any standard head of given size, and changes from one to the other may be quickly made. Kit available for changing any standard Porter tool into universal swivel type at small expense. — H. K. Porter, Inc., Everett, Mass.





LOW GROUND PRESSURE is outstanding feature of new model P & H dragline designed primarily for work on irrigation and drainage jobs where soft ground is encountered. Machine is provided with "mud shoes" by increasing crawler length to 15 ft. 9¼ in. Crawler shoes are 42 in. wide which reduces ground pressure to only 7.3 lb. per square inch. Traction is provided through simplified chain drive with fully machined gears enclosed to protect them from dirt and obstructions.—Harnischfeger Corp., Milwaukee, Wis.

FORM TIES *(left)* for construction of concrete walls of all sizes and with all types of forming, has 3,000-lb. load capacity and following additional features: Anchors welded to rod prevent turning within wall; breaking point of tie is 1 in. back of wall surface; special upset feature of rod prevents spreader washers from slipping along rod to cause uneven or incorrect wall thickness; spreader washers small enough to give positive spreader action; permits threading through forms from outside; washers are loose, so that bonding of concrete will not interfere with breaking of tie 1 in. inside wall. Application is as follows: After form is erected ¾-in. holes are drilled, ties are inserted from outside of forms *(left, above)*, gravity type tie-holder is placed *(left, below)*, later to be released by upward stroke of hammer. Tie is then broken 1 in. back of surface by wrench. Forms are stripped and small rod hole pointed to finish.—Richmond Screw Anchor Co., Inc., 243-253 Bush St., Brooklyn, N. Y.

If You Want Further Information —

Within the space limits of this page it is impossible to present complete information about the products illustrated.

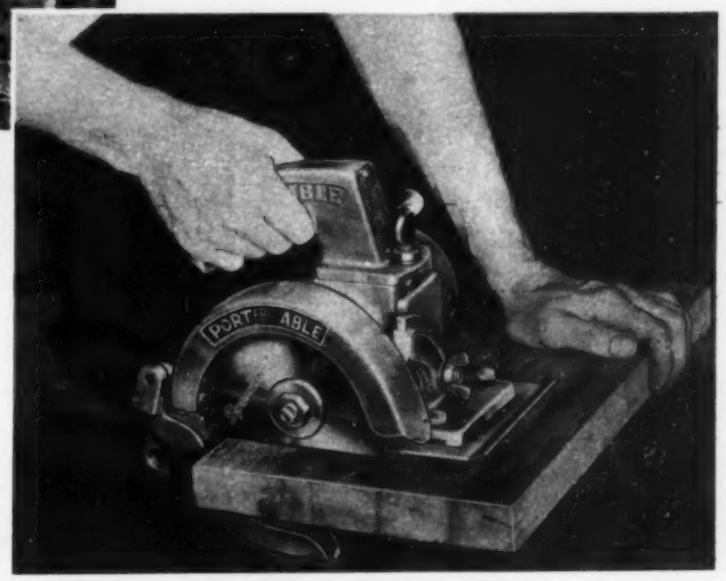
The manufacturers, however, will be glad to supply further details if you will write to them.

LARGER BORE MODEL *(insert)* has been added to Hercules series of 6-cylinder gasoline engines. This unit, 4x4¼-in., 320 cu.in. displacement, develops 83.8 hp. at 2,800 r.p.m. and 65.5 hp. at 1,800 r.p.m. with maximum torque of 204 ft.-lb. at 1,000 r.p.m. The 2½-in. chrome molybdenum crankshaft is supported by seven bearings of high lead bronze precision type. Cylinder head is detachable. Forced feed lubrication. Furnished in three other sizes. Photograph *(above)* shows Bucyrus-Erie shovel equipped with one of these 6-cylinder 3⅝x4¼-in. engines.—Hercules Motors Corp., Canton, Ohio.

WAGON SCRAPER, tractor-operated, of 5-yd. capacity, can be used either as a combination scraper and wagon or as a regular wagon for use with elevating graders and shovels. This unit digs or scoops, loads, transports rapidly, windrows and backfills. After scraper scoops load into tight enclosure, front extension apron covers over cutting edge and all weight is transferred to two pneumatic tire wheels. Unloads just like truck, depositing material in pile, windrow or backfill. Hydraulically operated and automatically adjusts itself to various earth requirements.—Continental Roll & Steel Foundry Co., 332 S. Michigan Ave., Chicago, Ill.

ELECTRIC METAL SCALING HAMMERS for removing deeply pitted paint, rust or scale from metal without damage or chipping of rivet heads. Powered by portable 300-, 500- or 2,000-watt gas-electric plant consisting of single-cylinder, air-cooled engine, direct-connected to 110-v., single-phase, a.c. generator. In addition to supplying electricity for operating hammers, these plants will furnish power for operation of other portable tools, such as drills, grinders and scaling brushes. Standard scaling chisels and 4-point scaling tools are used with hammers.—Syntron Co., 400 N. Lexington Ave., Pittsburgh, Pa.

GREATER RIDING COMFORT, increased steering ease, smoother operation and longer life are advantages resulting from new design of this tractor. Vibration caused by wearing clutch parts has been eliminated by improved support of this mechanism on its various bearings, assuring proper rotating balance. Other improvements: Extended crawler housing gives greater protection to drive sprocket; track shoes uniformly heat treated; deep leather upholstered seat and more leg room for operator; pressure of steering brake has been increased. New tractor has drawbar pull of 43 hp. and can be powered for either diesel, oil or gasoline.—Bates Manufacturing Co., Joliet, Ill.



6-IN. PORTABLE SAW *(right)* with cutting capacity of 1⅞ in. for use of carpenters and maintenance men, has following features:—Light weight (12 lb.); fingertip depth and angle adjustment—raises and lowers to desired depth and tilts to 45 deg. angle; blade automatically guarded in every position; safety guard control for pocket cutting; blade may be changed without removing any part of frame or guard; takes standard 6-in. blade; special universal-motor developing ½ hp. at idle speed of 5,000 r.p.m.; cutting speed, 4,000 r.p.m.; sturdy gear drive; ball-bearing throughout.—The Porter-Cable Machine Co., Syracuse, N.Y.

An unusually important series of articles, on

Job Management in Road Building

by J. L. HARRISON

Senior Highway Engineer,
U. S. Bureau of Public Roads, Washington, D. C.

starts in MARCH

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The series will consist of six illustrated articles dealing with factors that affect equipment selection, operation and dependability, production and cost, written from the point of view of the construction superintendent.

Mr. Harrison needs no introduction to the construction field—as senior highway engineer of the United States Bureau of Public Roads, Washington, D. C., he is well known to construction men interested in all phases of highway work.

And coming at a time when the organization and proper tooling of the job assumes an importance never before reached, this represents one of the most important series of articles that it has been our pleasure to include in Construction Methods in many a long period.

Job management spells the difference between construction profits and losses in these days of keen competition for contracts. These articles therefore will appeal to the dollars-and-cents interest of all construction men, both engineers and contractors.

J. L. HARRISON

Studied civil engineering at University of Nebraska. Graduated in 1908. Appointed to Insular Civil Service for assignment to Bureau of Public Works, Philippine Islands. Served there 9 years in various capacities requiring direct contact with construction methods and practices. Handled much work involving problems identical with those faced by contractors in organizing and equipping their operations.

Returned to United States in 1917. Attached since that date to staff of Bureau of Public Roads. In 1923 Bureau began intensive examination of construction methods and practices directed toward analysis of efficiency in construction management. Mr. Harrison personally supervised much of this work and maintained intimate contact with all of it.

He has published a number of short articles as well as two books on construction methods and practices.

Moreover, while the series deals primarily with roadbuilding, its lessons have a broad general application throughout all kinds of construction. The same principles of organization, plant selection and operation to increase production, as are given for highway work, can be used with equal effectiveness in building a dam, erecting a bridge, or constructing a building.

As Mr. Harrison puts it—

"We have passed out of the period when equipment helped labor to do the work and into a period in which labor helps and guides the equipment which does the work. A radical change in the conception of job management results. It ceases to be primarily a management of men. It becomes a management of machines. The performance of the equipment is dominant; ***the performance of the men tends to become incidental. It is evident, therefore, that the organization of construction operations for production is not so much a matter of assembling men and training them to perform specific tasks as it is a matter of 'tooling' the successive processes by which production is had that a selected rate of output is mechanically possible.*** Once the various processes are correctly 'tooled' (equipped) there is little chance for serious loss to occur."

It is with pleasure that we make this announcement to you, feeling as we do that the series will be of vital interest to every one of our readers.

OUTLINE OF CHAPTERS

Chapter I—Daily Costs:

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- Mechanized and hand labor operations
- Old or new machines
- Equipment set-up
- Training and supervising men

Chapter II—Factors Governing High Production:

- Selecting rates of operation for "key" machines
- Production built around the machine
- Competent machine operators
- "Tooling" the job adequately
- "Under-tooling" in subordinate operations
- Wasting labor
- Utilizing the working day

Chapter III—Equipment Dependability:

- Delays caused by breakdowns
- "Catching-up" lost time
- Dependability factor
- Profits and dependability
- Maintaining scheduled production rate
- "Hay-wire" outfits

Chapter IV—Power Shovel Grading Operations:

- Rate of shovel operation
- Size of dipper and "pick-up"
- Hauling equipment
- Load-carrying capacity
- Ground conditions
- Speed of vehicular movement
- Lost time
- Hauling distance

Chapter V—Concrete Pavement Constructions:

- Fine grading
- Form setting
- Mixing and placing concrete
- Mixing cycle
- Haulage
- Training laborers
- Balancing productive capacity

Chapter VI—Bituminous Pavement Operations:

- Rate of output
- Asphalt plant the "key" producer
- Inadequate dryer capacity
- Machine spreading and finishing
- Rolling
- Low sub-grade
- Study of weather reports
- Foresight in materials delivery
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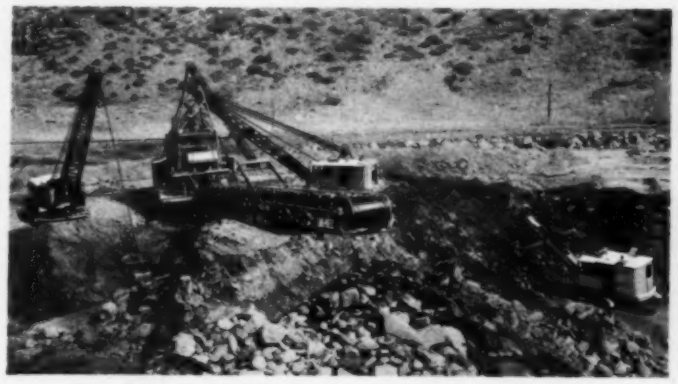
for Contractors, Road Builders and Engineers



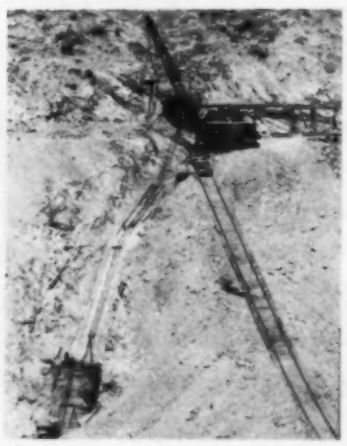
Recovering Placer Gold from Colorado's Famous Clear Creek

The prospector of old who "panned" the streams of Colorado for "pay-dirt" is being considerably outdone by this modern placer gold recovery equipment. It is owned and operated by Humphreys Gold Corp. on Clear Creek, near Denver, the scene of much of Colorado's gold mining activity since 1858.

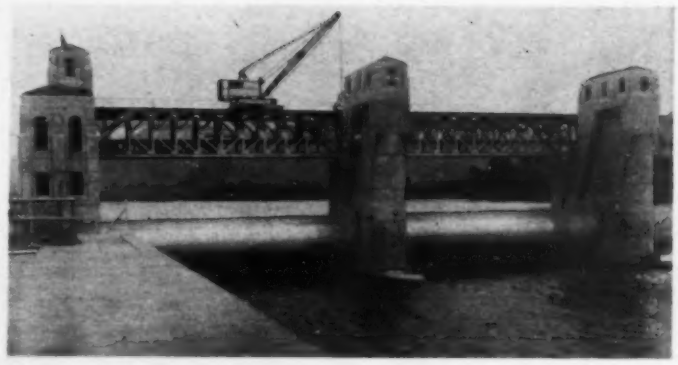
A Link-Belt K-38 shovel excavates to bed rock, and two Link-Belt draglines (a K-38 and K-48) deliver to the portable Link-Belt gravel screening stacker mounted on crawler treads. Note the large rocks in the foreground, which have been handled through the system.

This work is part of the 241-mile Metropolitan Water District aqueduct for bringing water from the intake on the Colorado River to Los Angeles and 12 other California cities. The accuracy of control, and unusual stability of the Link-Belt K-55 used on this job, made it possible to handle and lay these 40-ton pipe sections with ease and dispatch, even on the steep slopes.

Laying 40-ton Sections of Concrete Pipe



Mouth of tunnel and Link-Belt K-55 on upper level, particularly showing how the 40-ton pipe sections were hauled up and lowered into place on slope.



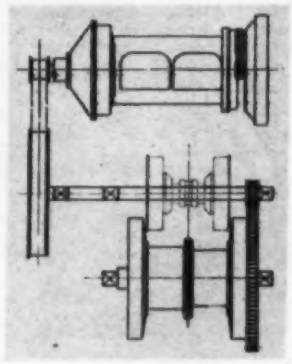
Navigation Dams for Inland Waterways

The extensive program of the War Dept. under the supervision of the U.S. Engineer Corps, for the development of navigation on inland waterways, is progressing rapidly. At present the center of activity is on the upper Mississippi River between St. Paul and St. Louis, where the construction of 27 movable dams is to be completed in two years.

Each of the first three dams completed in this program is of the roller-gate type, with a service bridge structure extending its entire length, on which a full-revolving, electric, self-propelled, wide-gauge Link-Belt locomotive crane is operated for general service, handling the poiree dam units, and for the removal of floating debris and sunken and water-logged drift accumulating in front of the roller-gates on the up-stream side.

Power is the Source of Speed

Power is essential to speed in shovel-crane-dragline work. Without ample power it is not possible to have generous speeds, unless the ability to do anything but the very lightest kind of work is sacrificed. It is not possible to get more out of a piece of equipment than the energy of power put into it.



The Link-Belt drive—from engine to drum shaft. Silent chain pinion on engine (or motor) shaft, and diameter of drum shells, readily changed to suit working conditions.

All Link-Belt heavy-duty Shovels-Cranes-Draglines will stand the slower speeds and maximum effort required for heavy-duty service, or the high speeds which are needed to produce maximum output in light service, or anything between these requirements. They are not confined to use in any particular class or classes of work, like a light or medium duty machine.

In the Link-Belt design, the speeds are easily changed to suit the work, by simply substituting the proper size of engine pinion and drum shells. These changes can be made quickly and inexpensively.

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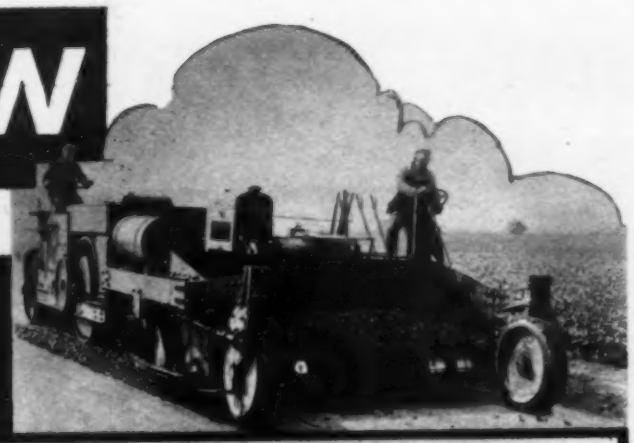

View of the material hopper showing power cut-off door closed.

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ADNUN engineers have brought the Black Top contractor three new exclusive advantages that mean vastly improved control and still better black top roads.

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The "Power Cut-off" shown above permits an immediate shut off of the flow of the black top material to the road. This is an untold advantage when laying at intersections or in crossing another piece of road running on a higher grade. It also eliminates tag-end drip when the hopper is almost empty or at the end of a station.

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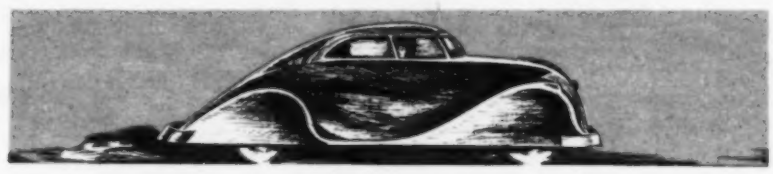

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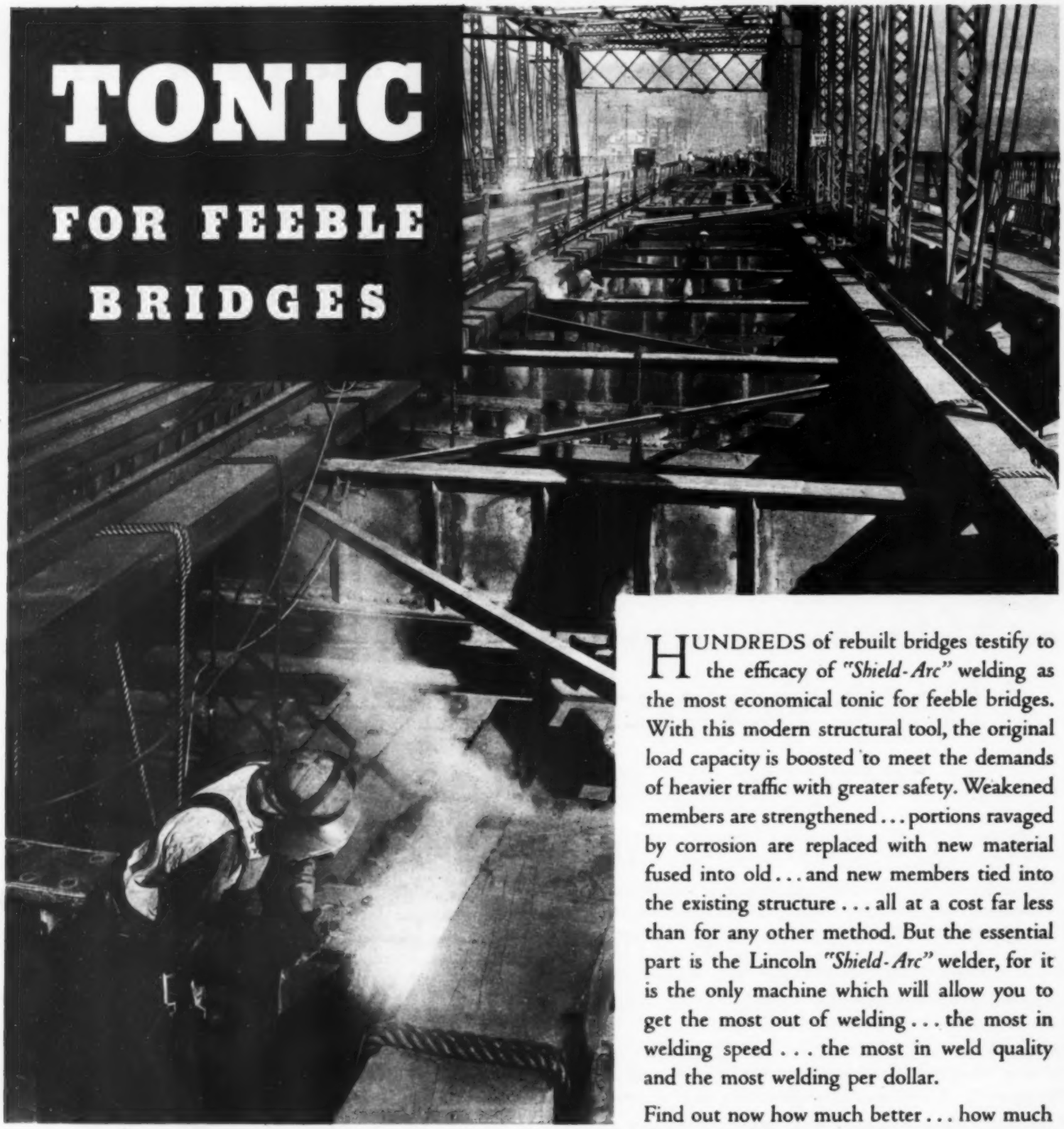
ATLAS EXPLOSIVES

TONIC FOR FEEBLE BRIDGES



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LAD "I've two tickets to the Follies tonight. How about going along?"

POP "Take your girl, Lad. I've seen all the follies I want to today. They were using an old machine for welding that bridge and every time the operator wanted to adjust his current he had to climb off and walk over to the welder. Believe me, I soon stopped that loss of time by putting a *"Shield-Arc"* equipped with 'Lincontrol' on the job. Now the operator has control right in his hands and no extra cables or rheostat to drag around, either."

LINCOLN

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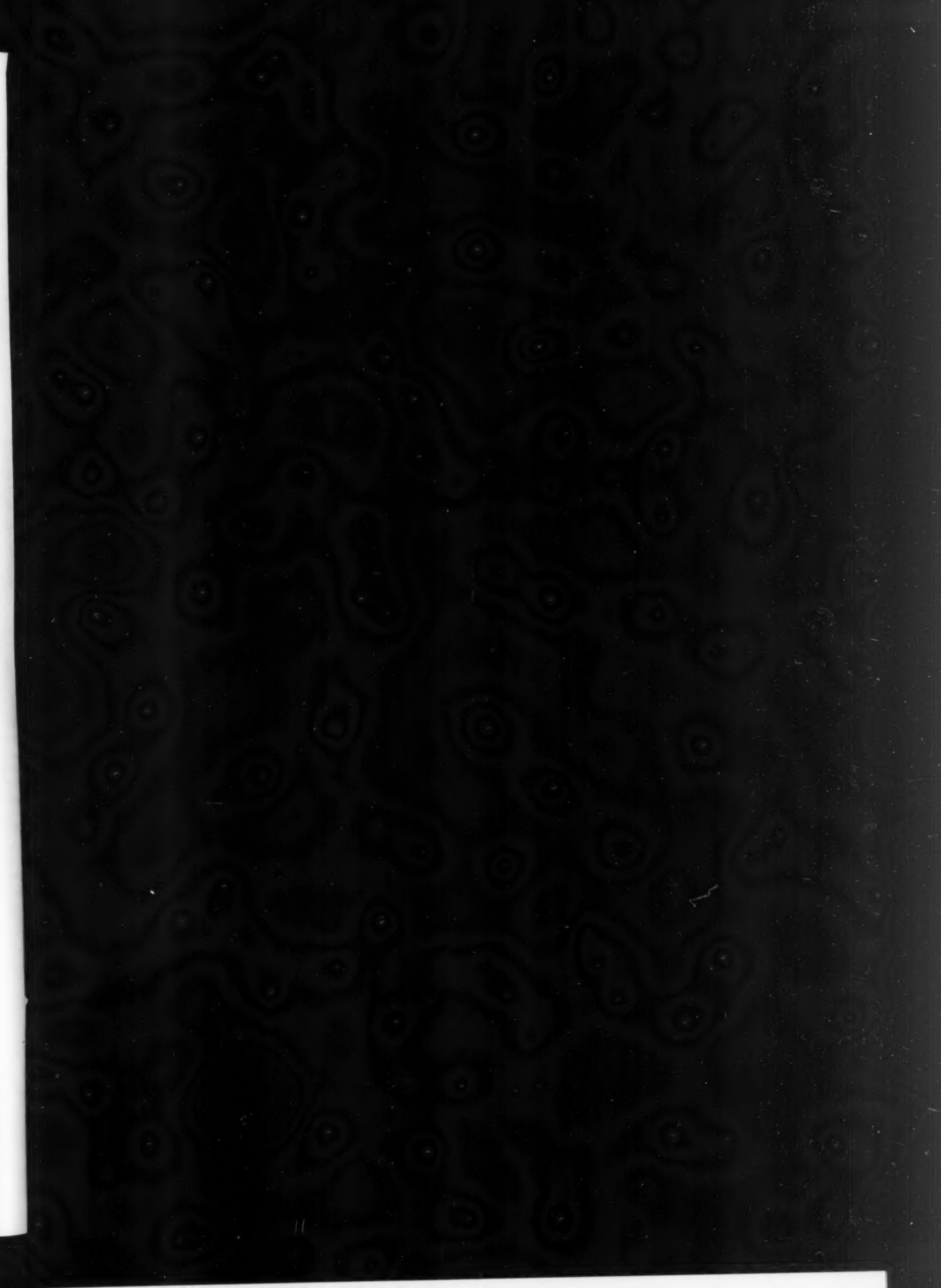

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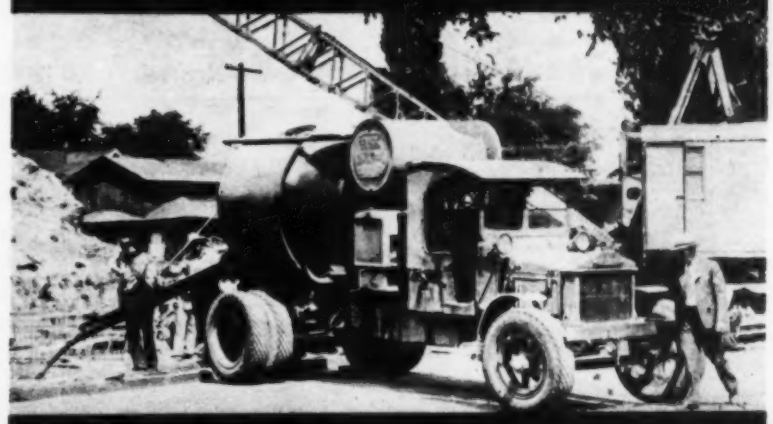

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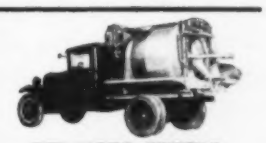

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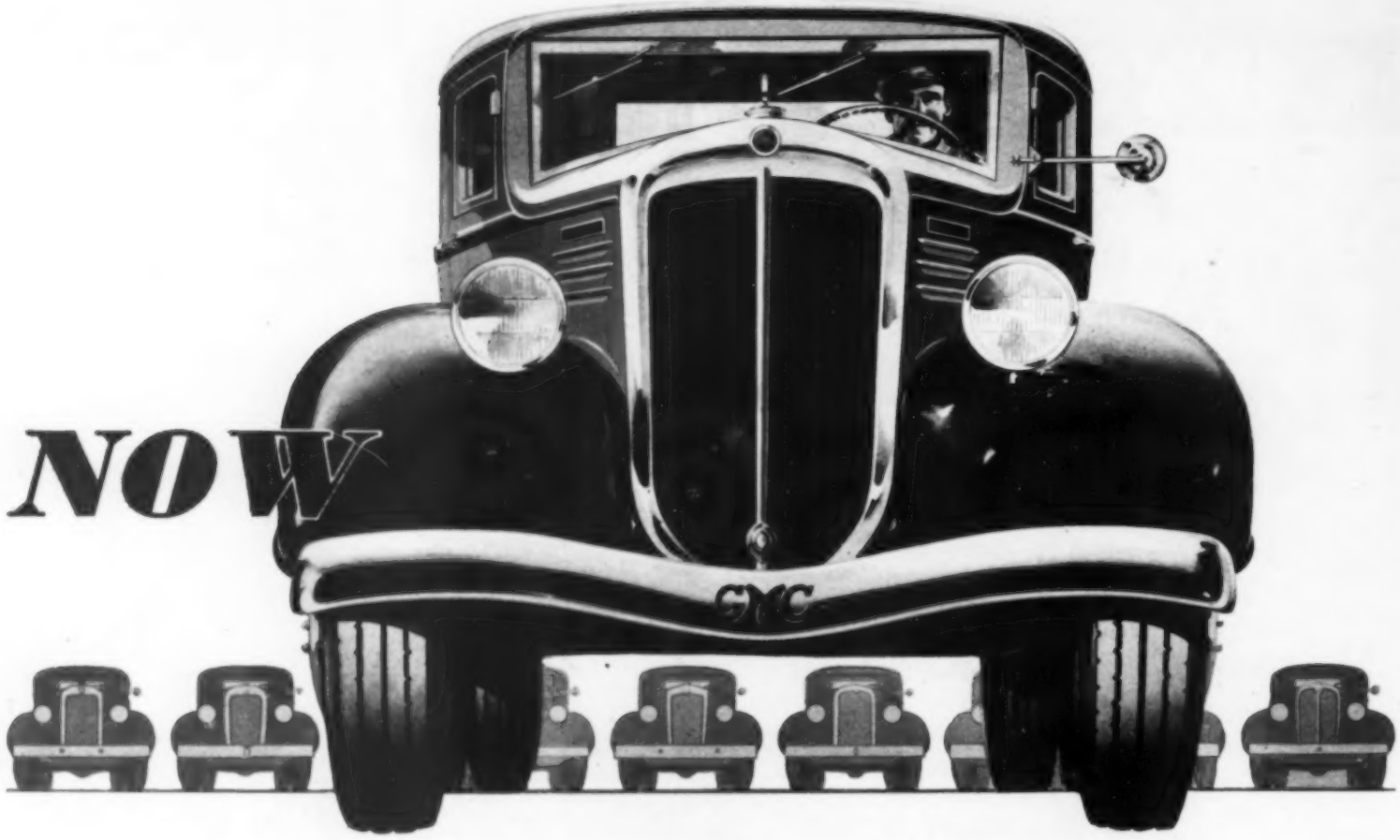
CENTRAL MIXING PLANTS

☐ Conveying Systems
☐ Contractors Elevators



NOW —out ahead with a wider lead than ever!

*Important 1935 improvements, including HYDRAULIC BRAKES, assure still better performance and greater earnings for GMC truck buyers

ON THE BASIS of comparative specifications or that of work done and profits earned, cold logic on the one hand and actual facts on the other have proved that General Motors Trucks challenge the entire field. Improvements, gradual and unheralded, have won for every unit in the entire line the confidence of an ever-increasing number of shrewd business men who judge truck value by the only sound yardstick, that of "earning ability" per dollar invested.

Now, at the start of 1935, important improvements, such as those listed below, assure still better performance, still greater economy, the ability to out-perform and the ability to out-earn in a more pronounced way than ever before.

More and more thousands of profit-minded truck buyers are swinging to General Motors Trucks. Even in the intensely competitive low-priced 1½-ton field of usage, shrewd buyers are proving daily that it pays to invest a few dollars more for the quality-built, all-feature 1½-ton to 2-ton GMC T-16.

A phone call to your nearest General Motors branch, distributor or dealer will bring you the bedrock facts. Representative models of the 1935 GMC line are now on display.

***NOTEWORTHY 1935 IMPROVEMENTS:**

Hydraulic brakes standard on all light and medium-duty models; centrifuse or cast nickel iron brake drums; exceptionally large braking surfaces; increased fuel economy; increased power; increased torque; dual-performance rear axle available in 2-3 ton range; finer appearance—sloping radiator, skirted fenders, fender-mounted headlamps, drop-skirted cabs, horizontal louvres and optional group of de luxe equipment (at slight extra cost).

GENERAL MOTORS TRUCKS *and* Trailers

1½ TO 22 TONS

GENERAL MOTORS TRUCK CO. Time Payments Available Through Our Own Y. M. A. C. PONTIAC, MICHIGAN

P&H

HAS SPEEDED UP *the* DIGGING CYCLE

FOR A BIGGER DAY'S WORK

WITH P & H ELECTRIC DRIVE

Abundant horsepower . . . faster swinging . . . balanced machinery units on the main working frame . . . less counterweight...these are some of the reasons why P&H Ward Leonards are big producers. In speeding up the swing as high as 3½ RPM, P&H engineers have licked the real problem of faster digging. Remember that the swing absorbs nearly 67% of the digging cycle.

If you've got a big job in dirt or rock, we will present some facts that will interest you. Better investigate these P&H Ward Leonards. Their modern design does things to handling costs.

HARNISCHFEGER CORPORATION

4494 W. NATIONAL AVE. *Established 1884* MILWAUKEE, WIS.

Warehouses and Service Stations:

Hoboken Memphis Jacksonville Seattle Dallas Los Angeles San Francisco

More Power, Less Weight Speed Up Action of P & H Electric Excavators

The outstanding feature of the P&H Ward Leonard is the faster operating speeds accomplished through high total horsepower and a more advantageous distribution of weight.

The latter refers to the careful grouping of generators, etc., back of the center of rotation to do away with most of the additional counterweight used in conventional designs. Less counterweight means less dead weight to consume motive power and retard action.

100% Electrical Control

Every move the machine makes is electrically controlled from the operator's cab and simplified to a remarkable degree. Steering, too, is accomplished through the use of hydraulic cylinders electrically controlled from the driver's seat. Travel speed runs as high as 1½ miles per hour—extremely fast for a machine of this size.

Main brakes and clutches are also hydraulically operated, eliminating hand levers, manually operated foot pedals, etc.

Hoist Mechanism

The unusually compact hoist mechanism is a sturdy high speed unit. The large hoist motor is connected to the hoist drum through a set of herringbone gears and a set of massive spur gears. The first reduction mechanism is equipped with anti-friction bearings and operates in an oil bath. The large, heavily loaded hoist drum shaft turns in a long, bronze, sleeve bearing.

The hoist drum, of large diameter, with turned grooves, is easy on cable.

Swing is Faster

On the larger models two swing units are employed. Vertical type motors are used, thereby avoiding the use of spur gears. The helical cut gears are longer lived and operate more quietly—the gears operate in an oil bath. All shafting is mounted in anti-friction bearings. The entire mechanism has been given a large factor of safety to withstand, for a long period of years, the heavy service imposed. Starting from rest the speed of the swing motors increases gradually, thereby reaching maximum speed as quickly as possible—yet smoothly and quietly.

P&H

WARD LEONARD ELECTRIC EXCAVATORS

● *Photograph showing diagramatically the manner in which the steel bearing piles are encased in concrete.*

THREE-PILE BENTS

with these steel bearing piles *speed up bridge construction*

● Three-pile bents, using steel bearing piles, reduced the cost and expedited the building of this Missouri Pacific Railroad Company bridge at Wichita, Kansas. With this type of construction, it was unnecessary to remove portions of the old structure in driving the new piles. This permitted utilization of working time to the fullest extent.

For hard driving or in locations where substantial bottoms are difficult to reach, CB SECTIONS as bearing piles provide a sound and economical foundation. The ease with which they can be driven means usually a definite saving in construction time and cost. In the bridge here illustrated the piles were driven through 35 to 40 feet of sand to reach firm shale. Jetting was unnecessary and no difficulties in driving were encountered. Additional information on the use of steel bearing piles in both railway and highway bridges may be had upon request.

U·S STEEL

Illinois Steel Company

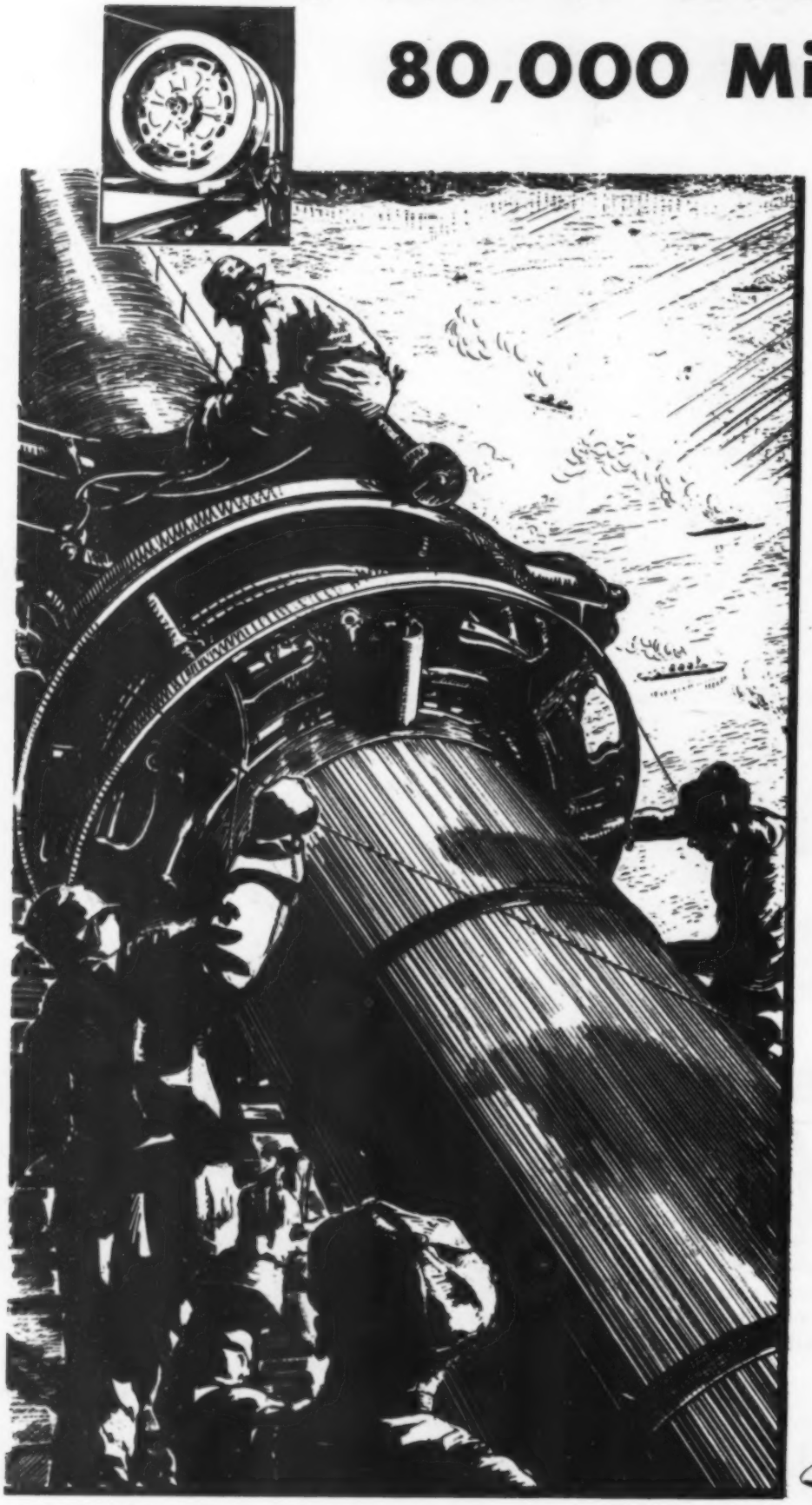
SUBSIDIARY OF UNITED STATES STEEL CORPORATION

208 SOUTH LA SALLE STREET • • CHICAGO, ILLINOIS

STEEL BEARING PILES

I ═══ I CB SECTIONS

A LIFE-LINE
80,000 Miles Long!



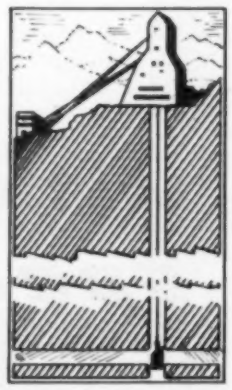
When the great bridge to be thrown across San Francisco's famed Golden Gate is completed, the safety of countless thousands will largely depend on two mighty main cables of steel. Weight: 11,000 tons each.

Spun by Roebling, these cables will contain 80,000 miles of Roebling Open-hearth Acid Steel Wire...wire noted the world-over for its strength, toughness, and stamina.

STEEL THAT "CAN TAKE IT"—MADE BY ROEBLING'S CUSTOM METHODS

All Roebling Steel for bridge cables and wire rope is made in small, acid open-hearth furnaces...in Roebling's own mill...by painstaking custom methods. The exceptional uniformity and fatigue-resistance of Roebling Wire are largely due to this fine steel.

OVER 1 MILE INTO THE BOWELS OF THE EARTH

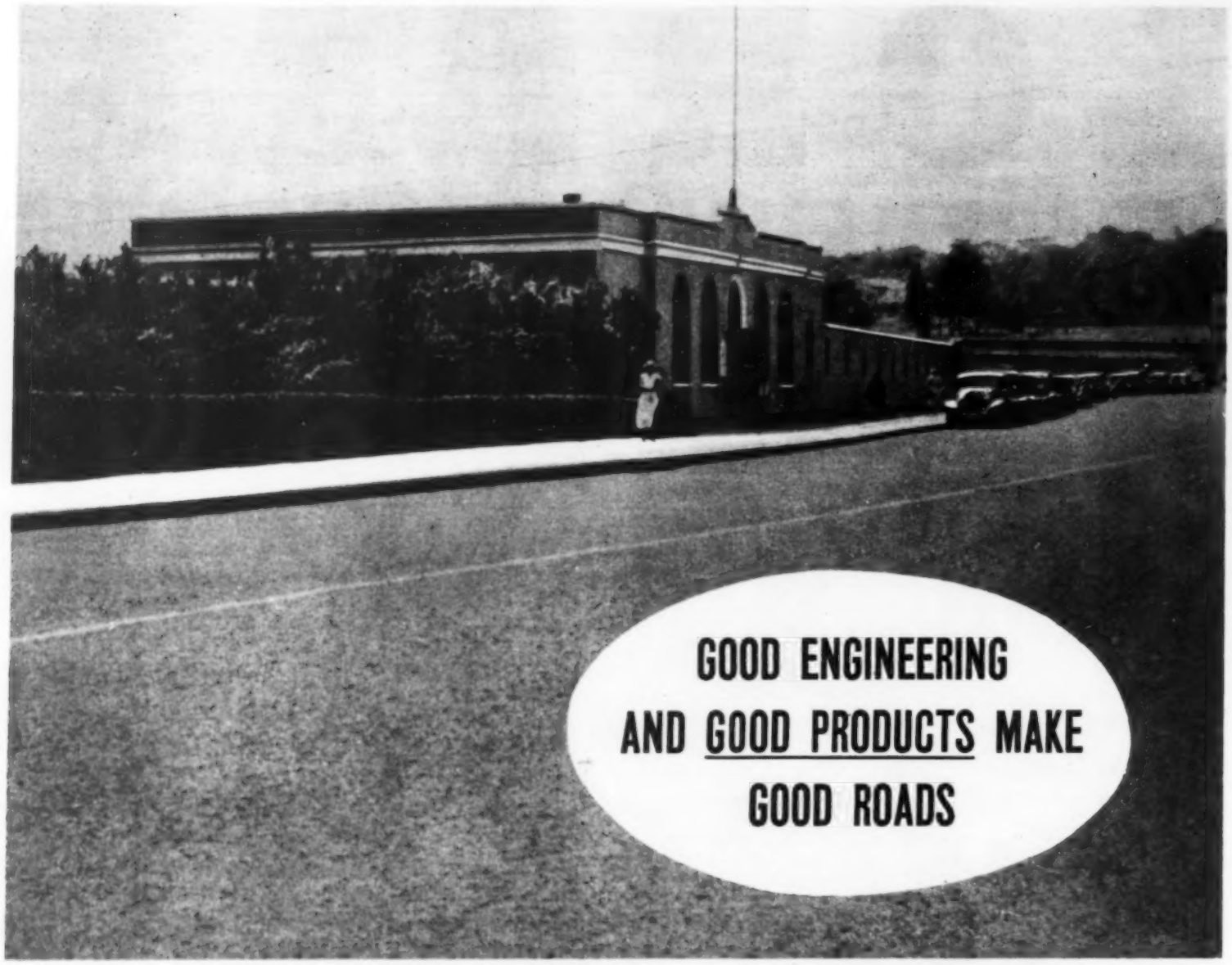


At new Ross Shaft of Homestake Mining Co, Lead, S.D., Roebling 1⅞" "Blue Center" Wire Rope is used for the ore hoist, one of the largest of its kind in the world. Active vertical lift now 5000 ft., eventually will be 5400 ft., over a mile.

DIRIGIBLE "MACON" USES ROEBLING BALLAST CONTROL ROPES

TO MAKE CERTAIN that Roebling Wire Rope will give the user the highest obtainable degree of safe, economical service, Roebling has enlisted the aid of the finest and most complete research, testing and manufacturing facilities. The small, acid open-hearth furnaces shown are examples. John A. Roebling's Sons Co., Trenton, N. J.

ROEBLING ...THE PACEMAKER IN WIRE ROPE DEVELOPMENT



STANDARD ASPHALT BINDER "C," SOCONY BRAND, PENETRATION MACADAM. THE BATH HOUSE, NEWPORT, RHODE ISLAND

STANDARD
ASPHALTS
AND
ROAD OILS
SOCONY BRAND

Standard Asphalt Road Oils
Standard Asphalt Joint Fillers
Standard Waterproofing Asphalt
Standard Cut-Back Surfacing Asphalt
Standard Asphalt Binder A for surface treatment
Standard Refined Asphalt for sheet asphalt paving
Standard Cold Patch Asphalt for all types of patching
Standard Asphalt Binders B & C for penetration work (Asphalt Macadam)
Standard Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete)
Standard Asphalt Emulsion for Surface Treatment, Penetration, Road and Plant Mix, and Patching

Specifications and all other particulars furnished on request.

SOCONY-VACUUM OIL CO.
INCORPORATED
STANDARD OIL OF NEW YORK DIVISION

is hauled by

INTERNATIONAL TRUCKS

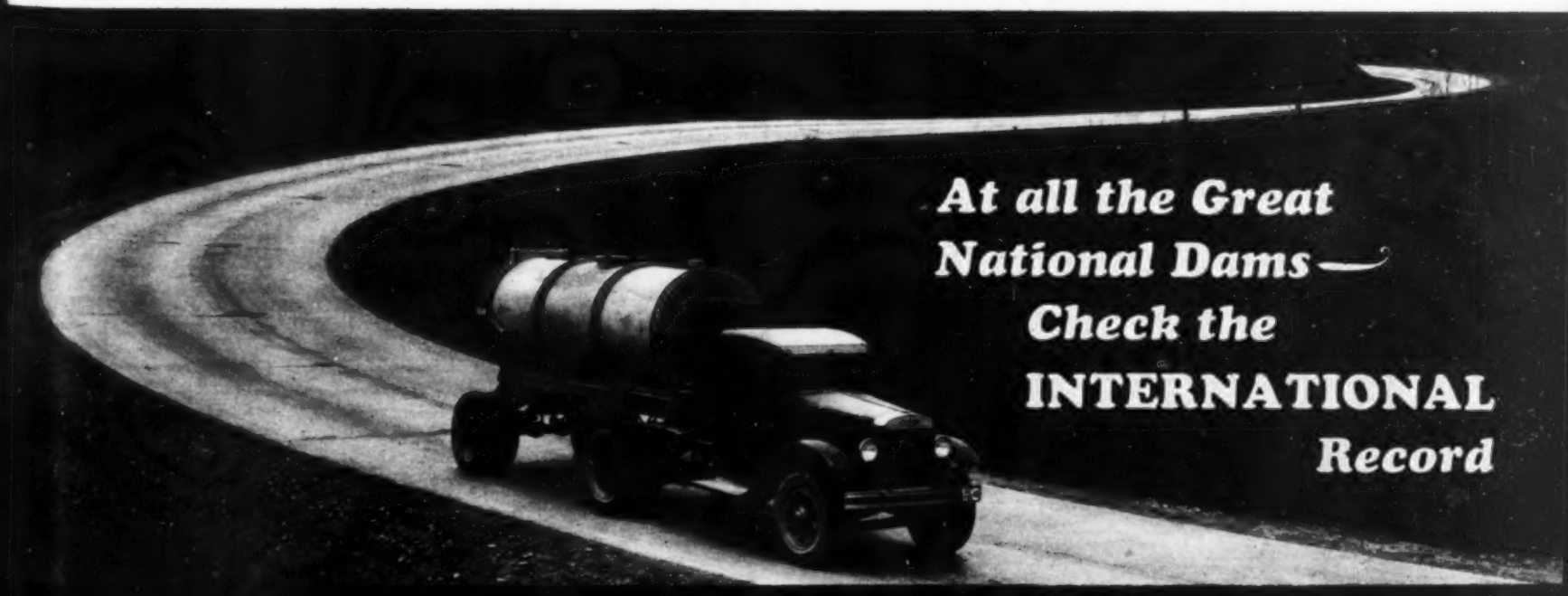
Originally a railroad was planned to get the vast tonnage of cement and reinforcement steel from the railroad siding at Coal Creek, Tenn., up to Norris Dam, but a show-down on efficiency gave the job to trucks—INTERNATIONALS.

A scenic highway 4.8 miles in length was built up the steep grades (eventually it will continue on over the completed dam) and a fleet of International Model A-8 tractor-trucks with semi-trailers got onto the job, to carry on twenty-four hours a day during the many months of dam construction. The aluminum tanks of the trailers hold a capacity of 65 bbl. or 24,440 lb. of cement. Steel and lumber are hauled on other types of trailers.

On the Tennessee Valley projects, as on the most spectacular construction enterprises elsewhere in the country, International Trucks are playing a generous part, consistently dependable, efficient, economical.

Service through 217 Company-owned branches.

INTERNATIONAL HARVESTER COMPANY OF AMERICA, INC.
606 South Michigan Avenue, Chicago, Ill.



Built Stronger For Rougher Usage

THE IMPROVED MODEL

of the

"FAVORITE" Reversible Ratchet WRENCH

Is Just The Tool For Contractors

on the nut-turning portion of the contract
that must be speeded up

BUILT OF A STRONG, TOUGH METAL

Works on a quick straight-ahead ratchet movement, and the socket form of head is not removed from the nut until operation is completed.

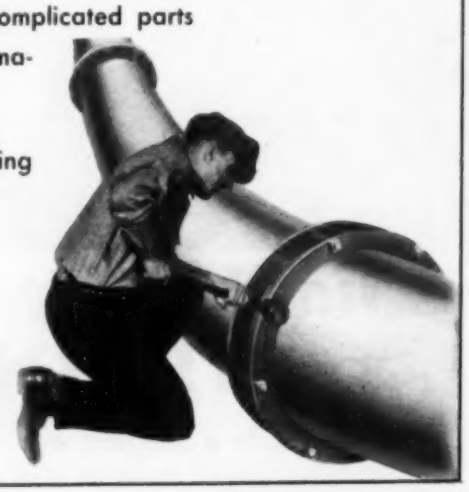
Can be used in narrower places than an ordinary wrench.

CADMIUM FINISH

A TIME-SAVER

The design of the "Favorite" wrench is simplicity itself, having no complicated parts necessitating expensive machine work.

It is an efficient time-saving tool at a proper price.



Write for full particulars

GREENE, TWEED & CO.,
109 Duane St. New York
Sole Manufacturers

It is so simple and it will save you so MUCH MONEY to know your cable loads

Money saved when they are right, money wasted when they are wrong.

You can check the load on any line on the Job with a Martin-Decker, Shunt Type Tension Indicator, quickly and accurately, without dead-ending or cutting.

Two sizes—for cables ¼" to 2⅜" in diameter; loads up to 260,000 pounds.

Write for descriptive literature

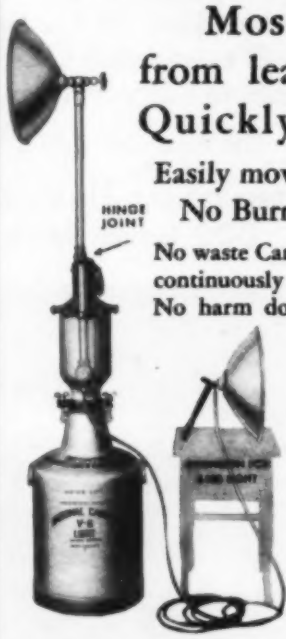
MARTIN-DECKER CORPORATION
3431 Cherry Avenue, Box 249 Long Beach, Calif.
U. S. A.

NATIONAL CARBIDE

V-G LIGHTS

Most Light from least Carbide Quickly Charged

Easily moved—No wires
No Burner Troubles



No waste Carbide whether used continuously or intermittently
No harm done if tipped over

—

Extension to X-100 DOUBLES THE CANDLE POWER *fastens anywhere*

—

Always use NATIONAL CARBIDE *"In the Red Drum"* Distributors Coast to Coast

—

WRITE FOR COMPLETE INFORMATION

—

X-100
NATIONAL CARBIDE V-G LIGHT
About 8,000 c.p. for 12 hours on 7 lb. charge of National Carbide. Easily handled by one man. Weight 35 lbs. empty; 98 lbs. full.

Y199
NATIONAL CARBIDE V-G HANDY LIGHT
Burns about 5½ hours on 1¾ lbs. of 14-ND Carbide, 2 gals. water; delivers about 1500 c.p. Weighs 37 lbs. charged—easy to carry, handy in emergencies.

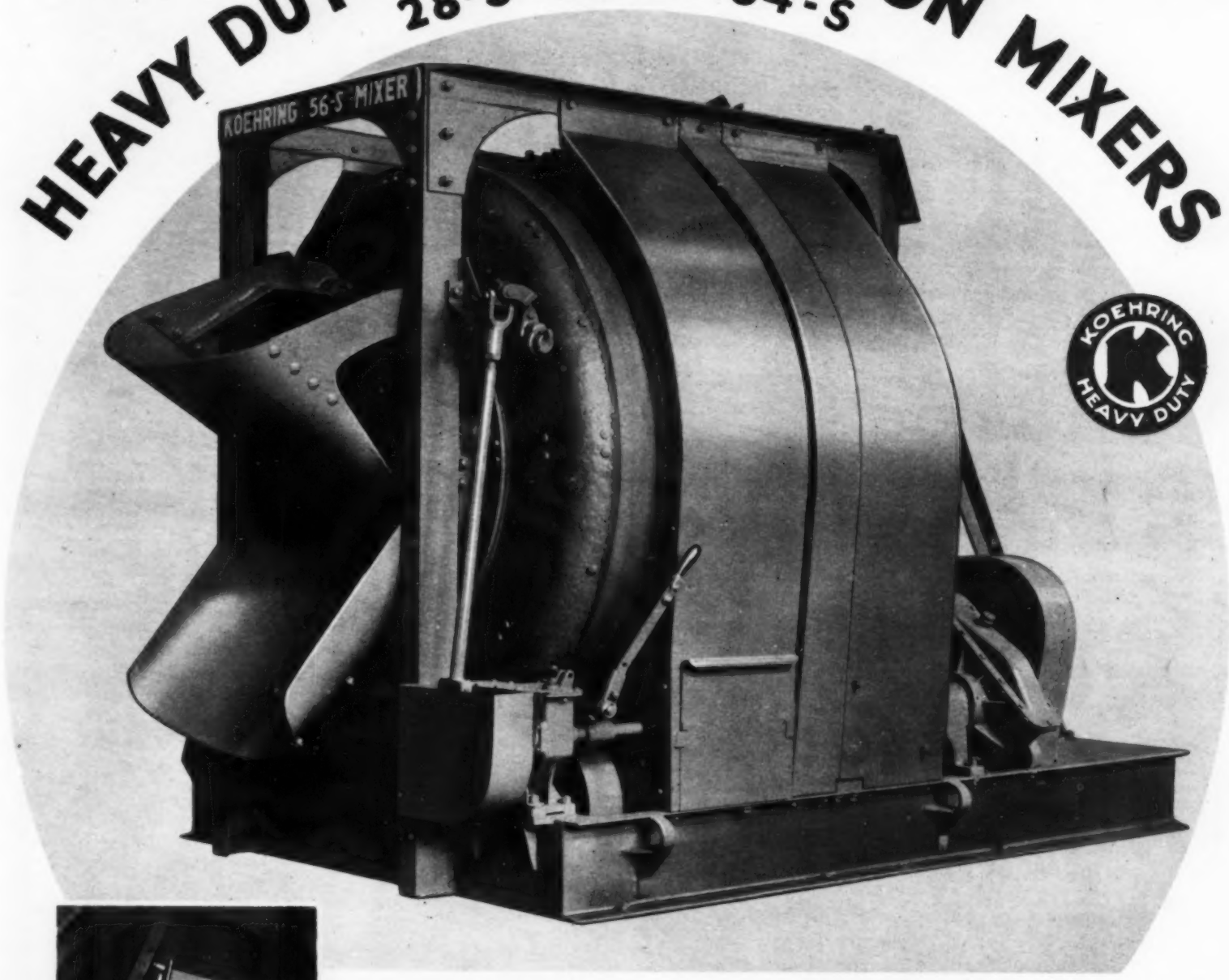
WL1-C1
NATIONAL CARBIDE LANTERN
Burns 8 hrs. on 8 oz. of Carbide. Brilliant rear signal of red, blue or green, no extra charge . . . Ideal for emergency lighting on road at night.

NATIONAL CARBIDE SALES CORP.
LINCOLN BUILDING
Opposite Grand Central, NEW YORK

KOEHRING

HEAVY DUTY CONSTRUCTION MIXERS

28-S • 56-S • 84-S



FASTER DISCHARGE with the KOEHRING Flow-Line Discharge.

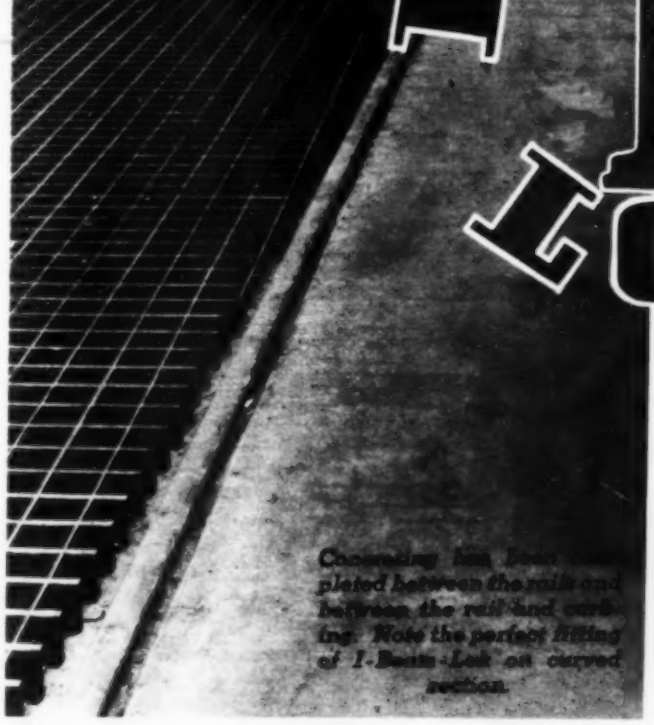
KOEHRING concrete mixers, suitable for large volume concrete projects as well as commercial concrete plants, are furnished in a range of sizes—28-S, 56-S, 84-S — adaptable to any job.

Short, compact frame design, because of the power plant, completely housed, directly *behind* the drum — and exceptionally low overall height — therefore, less space required for plant installation.

The Koehring Flow-Line discharge greatly decreases discharge time—causes a minimum of segregation—substantially reduces abrasive wear and permits an unbroken, natural flow of concrete.

Greater yardage—because of fast charging and speedy Flow-Line discharge — continuous operation because of Heavy Duty Construction—are important profit-earning features of Koehring Mixers.

KOEHRING COMPANY
MILWAUKEE WISCONSIN



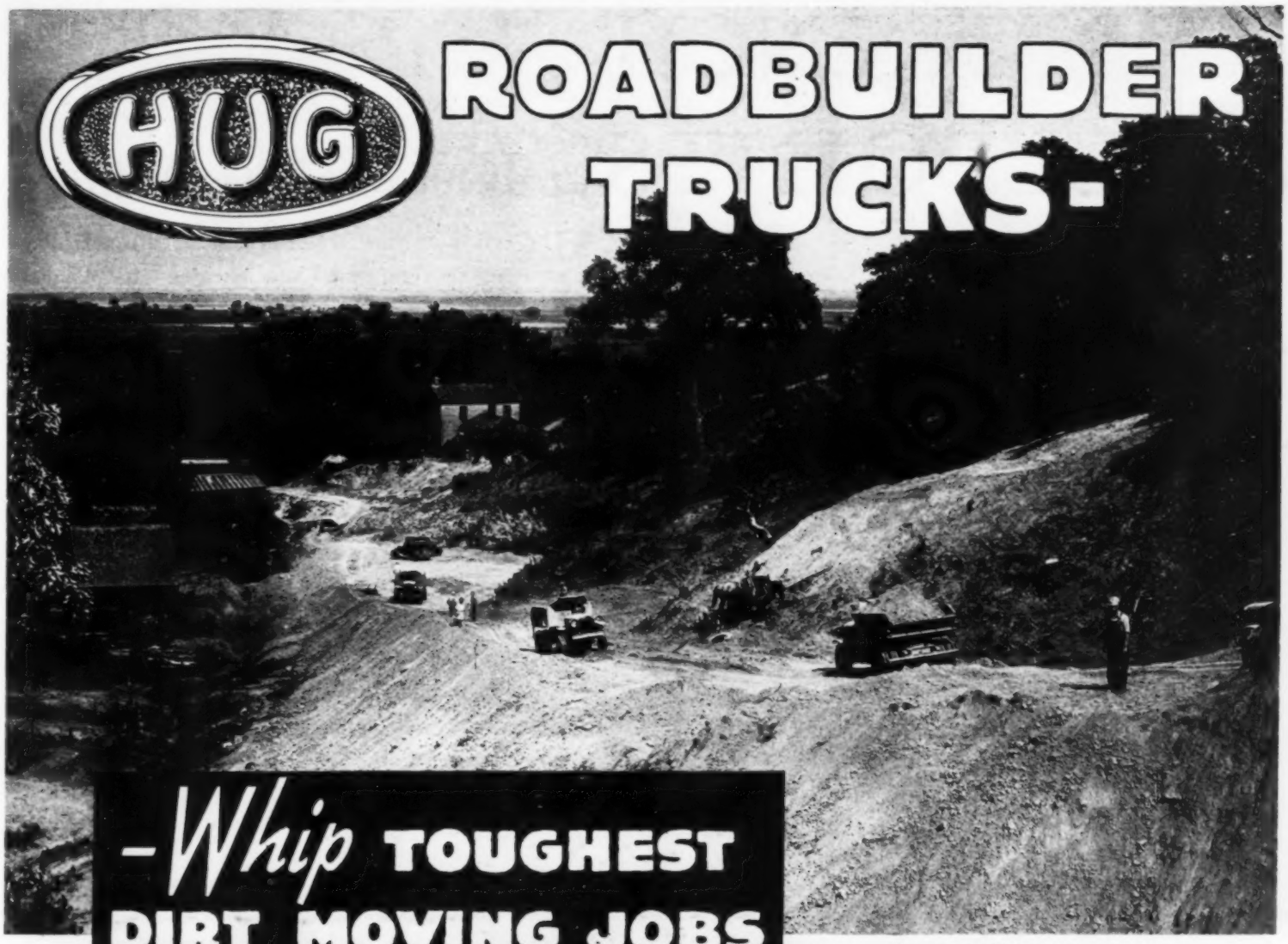
ARMORED

The historic Eads Bridge at St. Louis, the first bridge over the Mississippi River, erected in 1867 to 1874, has a new lease on life! Reflooring was necessary on the Southeast Approach and I-Beam-Lok was chosen for this important installation. • Engineers and contractors have quickly accepted I-Beam-Lok Bridge Floor Construction. They like the ease and speed with which it is installed. They are pleased with the completed work . . . the armored, anti-skid, long-life surface. And those who pay the bills appreciate its economy. I-Beam-Lok is suitable for both new work and reflooring. Let our engineers bring you complete details. 304

CARNEGIE STEEL COMPANY • PITTSBURGH • PA•

United States Steel Corporation Subsidiary

HUG ROADBUILDER TRUCKS-



-Whip TOUGHEST DIRT MOVING JOBS

Fleet of 4 Model 87Q Hug Roadbuilders, owned by McGlone Construction Company, on Illinois Route 105, Chambersburg, Illinois.

SAND. Dirt. Muck. Rocky roads. Steep grades. Hairpin turns. They're all easy going for Hugs — because Hugs are built especially to meet and whip *every unusual condition.*

Hugs amble right along with mammoth loads over ground impassable to others. And they come back for more at a speed that runs circles around ordinary trucks. They slip in and out under shovels, draglines and other tight places as easily as a wheelbarrow.

The thing that amazes Hug owners most, though, is that their Hug Roadbuilders carry on just as powerful and smooth — not for just a season or two — but *year after year* — making them truly most economical, too.

Rugged construction — powerful, heavy duty engine, rear axle and transmission — "I"-beam frame — the famous Hug set-back wheel design — short wheelbase — proven Hug front axle rocker action — equalized load distribution and passenger car ease of steering — are some of the "reasons why" you should investigate Hug Roadbuilders before investing in trucks. Now available with full Diesel engines. 1¾ to 10-ton capacities. Write today for catalog and specifications on complete line of Hug Roadbuilder Trucks.

THE HUG COMPANY
500 CYPRESS STREET • HIGHLAND, ILL.

MODEL 87Q
HUG ROADBUILDER

equipped with Buda Heavy Duty 6-Cylinder Truck Engine, 8-inch "I"-beam frame, full-floating double reduction rear axle, 10 speeds forward and 4 speeds reverse transmission, Hug set-back wheel design, proven Hug front axle rocker action and heavy duty 5-yard power hoist excavation and rock body with extension over driver's seat.

"BUILT TO MEET A CONDITION"

$115 ON SKIDS
$125 ON WHEELS
2½ H.P.

Value to You

The Novo 2 in. Self Primer

SO THE CONTRACTOR MAY KNOW

The superiority of the Novo 2" Self-Priming Centrifugal Pump (Model VAS-2) is simply and graphically shown by the figures on the right.

You know ACTUAL VALUE when you see it. The ACTUAL figures tell the story — Look at the Capacity — Look at the Horse Power — Look at the Displacement — Look at the Construction — and then look at the PRICE.

Besides, these pumps have the exclusive *leather seals* that require no service and no replacement.

There is a complete line of Novo Injecto Price Self-Priming Centrifugal Pumps —2", 3", 4" and 6".

SEND THE COUPON
FOR FULL INFORMATION

ACTUAL

	Novo	Other Makes
CAPACITY	8500 GPH	6000 to 7200 GPH
HORSE POWER	2½ to 3	1½ to 2
ENGINE SIZE..	2¾x3½	{2¼ x 2¼ and 2½ x 2½
DISPLACEMENT	20.79 cu.in.	{8.95 and 12.28 cu. in.
CONSTRUCTION	water cooled channel base Timken Bearings	air cooled angle base

PUMPS · HOISTS · ENGINES
NOVO
ENGINE COMPANY
LANSING, MICHIGAN
LIGHT PLANTS · STARTING UNITS

NOVO ENGINE COMPANY
214 Porter St., Lansing, Michigan

Please send me the details on your New 2" Self-Primer Model VAS-2.

Name .....

Address .....

REO GUARANTEES TRUCK PERFORMANCE

IT IS a startling and unprecedented thing for a truck manufacturer to guarantee the performance of his product.

Since the origin of the industry it has been traditional among buyers to assume that there was no fixed measure of results—that some trucks might do the job claimed for them and others might fall far short of the glamorous preview.

Reo takes pleasure in wrecking this tradition.

We know so well that Reo trucks are built to last longer and perform better than the average, that we now GUARANTEE the performance of any Reo truck selected by the Reo Truck Performance Gage method and operated under the Reo Ability Rating System.

The Performance Gage is a simple slide rule by which factory-schooled Reo salesmen determine what power, axle ratio and tire sizes are required for any given operation. On this slide rule analysis they base their recommendation as to the type of truck to put in service.

On the Reo thus selected you will find an ABILITY RATING plate. On this plate you read exactly what may be expected of the truck in terms of maximum gross load capacity, percent of grade it will climb in high gear, and the safe loaded speed on paved, level highways.

Reo GUARANTEES that any Reo truck so chosen will make good on every point on the rating plate!

What this means in arranging schedules, cutting costs and improving service is too apparent to require elaboration.

It is scarcely conceivable that any operator will continue listening to idle claims and optimistic guesswork about trucks when he can have Reo's ASSURANCE OF SATISFACTION IN ADVANCE OF THE PURCHASE.

Blindfolded buying is ended! Truck selection and operation are at last put on a SOUND and SCIENTIFIC basis!

Write Reo or see your Reo dealer for full details of this history-making gua. antee!

Reo Speedwagons and Trucks range from ½ to 4-6 tons. New low prices—$495 and up. 32 wheelbases, all with famous Reo-built Truck Engines—Hydraulic Brakes. Tractor-Trailer units and buses with correct load distribution and maximum pay load capacity. All prices chassis f. o. b. Lansing, plus tax.

See the brilliant new streamlined Reo Speedwagons. Lowest prices, greatest values in Reo history. Ask your dealer or write Reo for the "Extra Value Disc". Free! Shows you at a glance how much more truck you get for your money when you buy a Reo.

REO MOTOR CAR COMPANY

LANSING, MICHIGAN

WORLD'S LOWEST PRICES

CHEVROLET

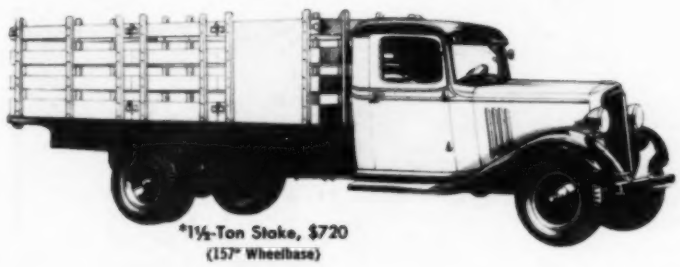
ALWAYS, *demand follows quality and value!* . . . Again in 1934, the insistent demand for Chevrolet products has made Chevrolet *the world's largest builder of trucks* as well as of passenger cars. And now, thanks to manufacturing economies resulting from volume production, Chevrolet offers still greater values—the *highest quality* Chevrolet Trucks ever built and the *lowest-priced* trucks you can buy! Economy is vitally important today. And truck buyers who want to save money will find that these are not only *the world's lowest-priced* trucks, but that they are also very economical to operate and maintain, due to the excellent quality which Chevrolet builds into them. They are big—rugged—dependable trucks. They are powered by *six-cylinder valve-in-head* engines which use very little gas and oil. And they are extremely long-lived . . . built to do their job and do it faithfully . . . at minimum cost . . . over a long period of years. Buy a Chevrolet Truck and you buy fine, dependable, economical haulage service—*at the world's lowest price!*

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

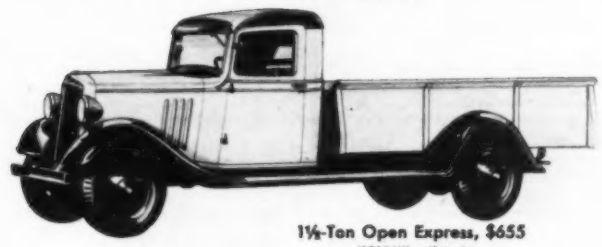
Compare Chevrolet's low delivered prices and easy G. M. A. C. terms. A General Motors Value

Half-Ton Pick-Up, $465
(112" Wheelbase)

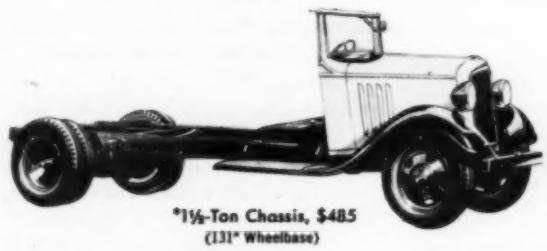
*1½-Ton Stake, $660
(131" Wheelbase)



*1½-Ton Stake, $720
(157" Wheelbase)



1½-Ton Open Express, $655
(131" Wheelbase)



*1½-Ton Chassis, $485
(131" Wheelbase)

*1½-Ton Chassis and Cab, $605
(157" Wheelbase)

*Above are list prices of commercial cars f. o. b. at Flint, Michigan. Special equipment extra. *Dual wheels and tires $20 extra. Prices subject to change without notice.*

CHEVROLET TRUCKS

EQUIPMENT and MATERIALS

An index of products made by manufacturers whose advertisements appear in this issue of Construction Methods.

If you do not find all you need in the advertising section, we shall be glad to assist you. Write to —

CONSTRUCTION METHODS
Information Bureau
330 West 42nd St. New York City

ASPHALT PLANTS
Blaw-Knox Co.

BACK FILLERS
Austin-Western Road Mchy. Co.
Harnischfeger Corp.
Northwest Engineering Co.

BARS, IRON AND STEEL
Carnegie Steel Company
Illinois Steel Co.
Inland Steel Co.

BATCHERS, ADJUSTABLE MEASURING
Blaw-Knox Co.

BINS, STORAGE
Blaw-Knox Co.
Chain Belt Company
Ransome Concrete Mchry. Co.

BLASTING ACCESSORIES
Atlas Powder Co.
Ensign-Bickford Co.

BOLTS, NAILS, NUTS, RIVETS and SPIKES
Illinois Steel Co.
Inland Steel Co.

BOOKS, ENGR. and TECHNICAL
McGraw-Hill Book Co.

BUCKETS
Blaw-Knox Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Link-Belt Co.
Northwest Engineering Co.
Ransome Concrete Mchry. Co.

BUILDINGS, STEEL
Blaw-Knox Co.

BULLDOZERS
Baker Mfg. Co.
Continental Roll & Steel Fdry. Co.
Le Tourneau, Inc., R. G.

CABLE, ELECTRIC
General Electric Co.
Roebling's Sons Company, J. A.

CARTS, CONCRETE
Ransome Concrete Mchry. Co.

CEMENT
International Cement Corp.
Universal Atlas Cement Co.

CEMENT (BULK) HANDLING EQUIP.
Barber-Greene Co.
Blaw-Knox Co.

CENTRAL MIXING PLANTS
Blaw-Knox Co.
Chain Belt Co.
Ransome Concrete Mchry. Co.

CHUTES, CONCRETE
Ransome Concrete Mchry. Co.

COMPRESSORS, AIR
Allis-Chalmers Mfg. Co.
General Electric Co.
Novo Engine Company

CONCRETE REINFORCEMENT
Carnegie Steel Company
Illinois Steel Co.
Inland Steel Co.
Wickwire Spencer Steel Co.

CONCRETE SLAB RAISING EQUIPMENT
Koehring Company

CONVEYING & STORAGE SYSTEMS
Barber-Greene Co.
Chain Belt Co.
Link Belt Co.

CONVEYORS, BELT, BUCKET & CHAIN
Barber-Greene Co.
Chain Belt Co.
Link Belt Co.
Wickwire Spencer Steel Co.

CRANES, GAS, ELECTRIC, DIESEL & STEAM
Austin-Western Road Mchy. Co.
Bucyrus Erie Co.
Harnischfeger Corp.
Koehring Company
Link Belt Co.
Northwest Engr. Co.
Thew Shovel Company

CRUSHERS & PULVERIZERS
Acme Road Mchry. Co.
Allis-Chalmers Mfg. Co.
Austin-Western Road Mchy. Co.
Good Roads Mchry. Co.

CULVERTS
Austin-Western Road Mchy. Co.

DERRICKS & DERRICK FITTINGS
Harnischfeger Corp.

DRAGLINES
(See Cranes & Shovels)

DREDGES
Bucyrus-Erie Co.
Harnischfeger Corp.
Link Belt Co.

DRILLS, WAGON
Bucyrus-Erie Co.

DYNAMITE
Atlas Powder Co.

ELEVATORS, BUCKET
Chain Belt Co.
Link Belt Co.

ELEVATORS, CONTR. MATERIAL
Barber-Greene Co.
Chain Belt Co.
Galion Iron Wks. & Mfg. Co.
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WIRE ROPE ACCESSORIES
Roebling's Sons Company, J. A.

WRENCHES
Greene-Tweed & Co.

For page reference see advertisers index, page 86

SERVICE SECTION

ADVERTISERS IN THIS ISSUE

Acme Road Mchy. Co. 86
Adnun Engr. & Mfg. Co. 60
Allis-Chalmers Mfg. Co. ...Center Spread
Alloy Steel & Metals Co. 86
American Cable Co. .....3rd Cover
American Pulley Co. 86
Ames Baldwin Wyoming Co. 76
Atlas Powder Co. 61
Austin-Western Road Mchy. Co. 19-20-21
Baker Mfg. Co. 82
Barber-Greene Co. 18
Barrett Company 8
Blaw-Knox Company 13
Bucyrus-Erie Co. 15
Caterpillar Tractor Co. .....2nd Cover
Carnegie Steel Company 75
Chain Belt Co. 63
Chevrolet Motor Truck Co. 83
Cleveland Tractor Co. .....4th Cover
Continental Roll & Steel Fdry. Co. ... 85
Du Pont de Nemours, Inc., E. I. 66
Ehrick, Inc., Fred 86
Ensign-Bickford Co. 16
Euclid Road Mchy. Co. 5
Fairbanks-Morse & Co. 80
Flexible Road Joint Machine Co. 86
Foote Co., Inc. 60
Fulton Bag & Cotton Mills 86
General Electric Co. 6
General Motors Truck Co. 64
Good Roads Mchy. Co. 86
Greene Tweed & Co. 72
Gulf Refining Co. 14
Harnischfeger Corp 65
Hug Company 77
Hutchison Eng. Wks. 86
Hydrauger Corp., Ltd. 86
Illinois Steel Co. 67
Inland Steel Co. 12
International Cement Corp. 7
International Harvester Co. 71
Jaeger Machine Co. 10-11-82
Koehring Company 73
La Bour Company 74
Le Tourneau, R. G. 78
L & M Mfg. Company 86
Lincoln Electric Co. 62
Link-Belt Company 57
McGraw-Hill Book Co. 74
Martin Decker Corp. 72
Moretrench Corp. 78
National Carbide Sales Corp. 72
Northwest Engineering Co. 9
Novo Engine Company 79
Ransome Concrete Mchy. Co. 82
Reo Motor Car Co. 81
Roebling's Sons Co., J. A. 68
Rogers Bros. Corp. 86
Searchlight Section 86
Service Section 86
Sika, Inc. 80
Socony-Vacuum Corp. 70
Spencer, White & Prentis, Inc. 86
Thew Shovel Co. 69
U. S. Steel Corp. Subsidiaries 22-67-75
Universal Atlas Cement Co 22
Wickwire-Spencer Steel Corp. 17

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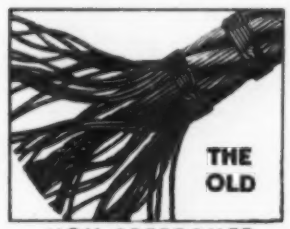

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